MINES.

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z, lead; s, silver; z, zinc.
on the Stock Exnds.

ON, and published at their office, 26 unications are re-

SUPPLEMENT.

The Mining Journal,

RAILWAY AND COMMERCIAL GAZETTE:

FORMING A COMPLETE RECORD OF THE PROCEEDINGS OF ALL PUBLIC COMPANIES.

No. 1866.—Vol. XLI. LONDON, SATURDAY, MAY 27, 1871. PRICE ..... FIVEPENCE. PER ANNUM, BY POST, £1 4s.

Original Correspondence.

THE MANUFACTURING INDUSTRY OF SCOTLAND.

YOUNG'S MINERAL OIL WORKS.

The works of Young's Paraffin Light and Mineral Oil Company at Bathgate are at once among the largest and the oldest in Scotland. They were erected on a very small scale by Mr. Young, the inventor of that rich quality of paraffin oil which bears his name, in the year 1851. Since that time they have been gradually and largely extended to meet the exigencies of an exceptionally prosperous business, until they now occupy 25 acres of ground, and are equal to the production, along with the Addiewell Works, which belong to the same company, of fully one-third of all the mineral oil manufactured in Scotland. In proceeding to describe the Bathgate Works, it may be more interesting if we seek at the same time to place before our readers some idea of the character of the operations they are intended to carry on.

The shale from which the mineral oil is extracted is brought from Addiewell, about six miles distant, where the company own, and regularly work for their own purposes, 11 pits. Communication by railway is provided between the two establishments, so that there are easy and ample facilities for sending out the manufactured article or bringing in the raw material. The shale is a hard, rusty description of bituminous coal, peculiar to this district. It is brought to the works in big lumps, and before being placed in the retorts it has to undergo the preliminary process of passing through a powerful crushing machine. There are several of these machines scattered about the premises, in close juxtaposition with the railway, by the side of which the shale is emptied from the wagons. Provision is made for having a large supply of shale always along side the retorts, into which it is emptied in regular instalments. There are upwards of 200 retorts, ranged in sets of four each. They have funnel-shaped tops, and are fitted with air-tight stoppers, each of them measuring about 12 ft. in length by 14 in. in diameter. In outward appearance the arrangement of the retorts is very curious. In order to shut out the air, and permit of the waste being removed without difficulty, the lower extremity of each retort is led into a pit filled with water, while the portion of the pipe passing through the furnace is maintained at a dull red heat, this being the point at which distillation is effected. The thermometer of the refrigerator should not be made too low, lest the product of the distillation should congeal and stop up the pipe, and the retort, when closed like an ordinary gas retort, is gradually heated up to a low red heat, at which it is kept until volatile products cease to come off. The oil is collected in a large main pipe, which conveys it to the condensers, close at hand. We should explain, however, that the oil is driven off in the form of vapour as the coal decomposes, and that it is in passing through the condensers the vapour are reduced to a liquid form. In the stills, of which there are from 140 to 150 on the works, varying in capacity from 1000 to 5000 gallons, the crude oil becomes considerably purified previous to being passed into the refineries, where it is treated chemically with sulphuric acid and soda. It is again run into other stills of a somewhat similar kind, and from these it yields four different products—to wit, paraffin oil for burning or lighting, lubricating oil for machinery, naptha, and what is termed paraffin scales. The impurities extracted from the crude oil are removed from the stills after each charge. In the next process the oil is run into circular iron tanks, each capable of holding a charge of from 4000 to 8000 gallons, where it is violently stirred and agitated by a revolving "stirrer," so that at the end of four hours or thereby the vitriol and organic impurities, which were held in solution, collect by reason of their greater weight in the bottom of the tank, and the finer oil, for which the acid has no affinity, is drawn off, and appears a pale green colour. The foreign substances and sediment are used for fuel. The oil is pumped into these tanks by ordinary plunging pumps. In running from the "agitator" the oil finds its way by gravitation into another set of tanks underneath the ground, where it is mixed with a strong solution of caustic soda, and still further agitated, so that any impurities still remaining may be got rid of. After being again treated with sulphuric acid and soda, the oil, containing the elements of the four products already mentioned, is subjected to a process which is technically termed destructive distillation, in the course of which the products are separated from each other, and made available for the purposes they were generally intended to serve, the lighter products coming off at a lower temperature, and the lubricating oil and paraffin being evolved at a higher temperature. This division having been effected, the burning oil and the naphtha are passed into another refinery, where they undergo a further chemical process, and they are finally distilled separately, in order to make them perfectly pure. The lubricating oil is passed into large cooling tanks, or refrigerating machines, where the scales of the paraffin are formed. These scales are afterwards used in the manufacture of paraffin candles, which is carried on at Bathgate to a considerable extent, although on a much larger scale at Addiewell.

Mr. Lavender, the talented manager of Bathgate Works, is the inventor of another produce, known as White Horse oil, the manufacture of which is now confined to this establishment alone. The curious name bestowed on the oil derives its etymology from the circumstance that Mr. Lavender was formerly the owner of works in Kent, and, as every one acquainted with the secrets of the Herald's Office must know, the armorial bearings of that delightful county are a white horse rampant, with the motto *in victa*. The White Horse oil is used to a very large extent in London, and its chief peculiarity lies in an entire absence of the nauseous smell by which all other kinds of mineral are more or less distinguished. Indeed, the little odour that the White Horse oil does give forth is rather pleasant than otherwise, while its purity and illuminating qualities are not surpassed by petroleum or any other kind of oil in the market. The management are careful to take advantage of anything in the shape of new appliances, when they promise to yield more economical results, and Mr. Lavender is just now engaged upon a new principle of condenser, which if its results are at all equal to his expectations he will apply to all the works. On this point, however, we are not now permitted to speak more definitely. When ready for the market the oil is stored in large stock tanks, each capable of containing from 100,000 to 140,000 gallons. A number of these tanks were formerly used as gasometers, and they serve their new application admirably well. Others have been specially constructed for the purpose. There are fifteen of these tanks altogether, but six of them in the older portion of the works are only adapted to hold from 50,000 to 60,000 gallons each. From the aggregate capacity of these tanks we can form something like an approximate idea of the immense stock which the company sometimes have on hand.

The process of cooling the oil is one involving some degree of care, and no little amount of trouble. In the cold weather it is chiefly effected by allowing the products of distillation to remain for as long a period as might be necessary in large tanks, placed under the most favourable conditions for cooling purposes. In hot weather, however, this system is wholly inoperative, and the manufacturers were often in a difficulty, until Mr. P. A. Kirk, the former manager of the Bathgate Works, invented a freezing machine, admirably adapted to secure the desired end. There are now two of these machines in operation at Bathgate, the largest of which is capable of producing about 2 tons of ice in the 24 hours. This machine is now tolerably well known, and its principle is certainly very simple, the ice being produced by a compression of air in the cylinders, which, upon being set free, absorbs the caloric of the surrounding atmosphere. Attached to each freezing machine there is an engine of 25-horse power, and the most powerful of the two has been added to the plant—along with a number of hydraulic presses, in which the paraffin scales are pressed previous to their being made into candles—within the past few months. These presses, we may add, are worked by steam-pumps, made by A. and P. Steven, engineers, Glasgow. Amonia and sulphuric acid are manufactured on the works for local consumption only, but it is in contemplation to erect additional premises, and carry on the manufacture of these products on a larger scale for the market. Caustic soda, which is used in the process of refinin g the oil, is also produced on the spot.

The accumulation of refuse from shale coal is enormous, and hence there are very large heaps of cinder in the vicinity of the Bathgate Chemical Works. The largest of these heaps is several hundred feet in height, and covers six or seven acres of ground. In viewing it from a distance one cannot but be struck with its resemblance to Arthur's Seat and Salisbury Crags, at Edinburgh, and so apparent is this similitude that the heap has been called after these notable lions of the Scottish metropolis. During the last winter Mr. Lavender took measures for having this large cinder heap covered with earth, and vegetation is now springing up so abundantly that there is every likelihood of what appeared to be only a desert waste becoming amenable to the art of the horticulturist. On the apex of the hill a large space has been enclosed, and tastefully laid off as a bowling-green, and a very accessible road leads from the base of the hill to its summit. This is a course from which those engaged in the manufacture of iron might well take a hint, and we commend it to their serious consideration. A little to the east of the hill we have described there is another large heap of cinder and waste, which took fire about two years ago; and as all efforts to extinguish it have proved unavailing it has been a great eyesore and rock of offence to the locality. It has done more harm to the vegetation round about than all the rest of the works put together—the volumes of dense black smoke that proceed from it both day and night having a most injurious tendency. It is thought, however, that the fire has nearly run its course, and that another six months will suffice to exhaust it.

THE BRITANNIA IRONWORKS, MIDDLESBOROUGH.

The construction of these works was commenced in July, 1870, on a site near the banks of the River Tees, until recently a marsh, which has been made available for the plant by covering it with slag. Mr. B. Samuelson, M.P., is the principal owner of the works.

The puddling and forge department is now nearly in a state of completion, and comprises 120 puddling-furnaces, two forge-trains, with steam-hammers and other appliances. The rolling of puddled bars was commenced at one of the forges in April of this year. The erection of the department for the manufacture of finished iron is in progress. This will consist of 12 Siemens' regenerative gas-heating furnaces and 32 gas producers; a blooming-mill on While's patent, which has two pairs of horizontal rolls and one vertical pair, its principal feature being that the pile is only once put through the mill; and a rail mill on Brown's patent for the manufacture of iron rails and accessories. By this method the rolling is performed in both directions by two pairs of rolls placed side by side, and there is continuous rotary motion of the rolls. The manufacture of steel rails is also in contemplation.

The puddling furnaces are of the ordinary construction, fitted with step grates, and built in four rows, 30 in each row. There is standing room for the workmen 24 ft. in width between the furnaces. Each row of furnaces is covered by a line of roofing, 16 ft. span, composed of wrought-iron, and slated, the entire length of each of which is 540 ft. Another shorter line of roofing, 40 ft. in span, parallel with the others, covers the engines, rolls, and steam-hammers.

Two forge engines are in position, side by side; each drives a forge-train of four pairs of 22-inch rolls. Each engine has one 36-inch horizontal cylinder, 4½-feet stroke, acting direct to the rolls, without any intervening spur gearing. The slide valve is worked by one eccentric rod, furnished with gear for reversing the motion of the engine, in case that should be required. The weight of each fly-wheel is 37 tons. These engines were manufactured by Messrs. M. Samuelson and Co., of Hull. Three single-acting steam-hammers are erected at the forge now in operation; each hammer weighs 6 tons, and each anvil block is 42 tons in weight. Three similar steam-hammers are in course of being erected for the second forge, not yet in operation. The steam-hammers and their fittings are from the works of Messrs. Thwaites and Garbutt, of Bradford. Cropping shears for puddled bars are placed in a central position for each train of rolls.

Sixty of the puddling furnaces have stack boilers attached to them; the shell of each boiler is 28 feet by 4½ feet, with one vertical flue 2½ feet in diameter, extending about 6 feet above the boiler; in each vertical flue there are fitted seven Galloway tapered cross-tubes. The boilers and steam-pipes are all being covered with non-conducting composition, secured by iron netting.

Steam is generated in these boilers at about 50 lbs. pressure, which will supply the two forge engines, six steam-hammers, the boiler feeders, and eventually other engines in the finished iron department. This form of furnace-heating boiler is proved by experience to be most safe, with the advantages of facility in raising steam, and not interfering at all with the operation of puddling. There are two Cameron's boiler-feeders erected; each has two inverted cylinders, two 4-in. rams, 6-in. stroke. The main steam-pipes, 12 in. diameter, are laid in an underground passage formed between the two lines of stack boilers, the whole length of the building—the feed-water pipes are placed in the same passage. By a peculiar bent arrangement of the steam pipes no expansion joints are required in this great length.

Between each two lines of puddling-furnaces an underground railway is laid in a culvert; by these the ashes from the whole of the furnaces will be conveyed away to the east end of the works, where they will be elevated by machinery, and tipped into large wagons.

On the south side of the puddling-furnaces the materials, as pig-iron, coal, iron ore, &c., are brought to them by a parallel railway, at an elevation of 10 ft. from the surface, extending a similar length (540 ft.) Under this railway a series of bunkers are constructed, for the storing of materials.

We believe this plant will be the largest ever put down at one time; it will, no doubt, add new fame to this already wonderful iron-producing district, when fairly embarked in its manufacture of iron and steel rails. The proprietors have in view the adoption of every recognised improvement. The forge department, as we have described it, is constructed with a view to economise labour and fuel. The finished-iron department is also designed to secure the same objects; a large proportion of the work usually done by hand will be effected by machinery, and, with the new appliances for rolling we have referred to, the whole is designed to be as perfect and self-acting as possible. A further notice of these at the period of completion will possess great interest to ironmasters.

THE SOUTH WALES INSTITUTE OF ENGINEERS.

A general meeting of this Institute was held at the Assembly Room of the Westgate Hotel, Newport, on Wednesday, May 10.

There were present, Mr. T. Dyne Steel, C.E., Vice-President, who occupied the chair, in the unavoidable absence of the President; Mr. W. T. Lewis, C.E., of Aberdare; Mr. A. Bassett, C.E., Cardiff; Mr. T. Joseph, Treherbert; Mr. G. Birbeck, Tondu; Mr. M. Truran, Dowlais; Mr. D. Thomas, Rhymney; Mr. G. Wilkinson, Aberdare; Mr. E. Brigden, Dowlais; Mr. G. Atkinson, Coleford; Mr. Banks, Pontymeister; Mr. Waddle, Llanelly; Mr. H. Trump, Rhymney; Mr. H. M. Maynard, Crumlin; Mr. F. H. Brown, M.E., Pontypool; Mr. J. T. Edmond, Mr. H. Kirkhouse, Mr. W. Thomas; Mr. J. M'Murtrie, Bath; Mr. J. Williams, Mr. T. G. Davies, Mr. C. L. Hunter, Mr. H. Huxham, M.E., Swansea, secretary, and numerous other gentlemen.

After the usual routine business had been got through, the following gentlemen were ballotted for, and declared duly elected as members:—Mr. F. W. Dunn, Tredegar; Mr. C. H. James, M.E., Merthyr Tydfil; Mr. M. John, Merthyr Tydfil; Mr. C. J. Sharpley, C.E., Allyheer, India; Mr. H. Harris, Nant-y-Glo; Mr. W. Lewis, Swansea; Mr. J. Barrow, Maesteg; Mr. R. A. Johnson, M.E., Burmah; and Mr. D. Joseph, Dunraven, as graduate.

The discussion of papers read at previous meetings was then proceeded with. In the absence of the writers, no remarks were offered upon the following papers:—

"On the Forest of Dean Coal Field," by Mr. Arnold Thomas.

"On the Cleveland Ironstones," by Mr. Thomas Allison.

"On the Cleveland Iron Furnaces," by Mr. Edward Williams.

"On the Application of Blast at a High Temperature to Blast-Furnaces of Moderate Elevation," by Mr. Thomas Whitwell.

"On the Meteorological Influence upon Mine Ventilation, and on Recording Ventilation Registers," by Mr. William Morgans.

Upon Mr. E. W. Richards's paper "On Bérard's Coal-Washing Machine," an interesting discussion ensued.

Mr. Birbeck said that since the last meeting he had made some experiments in coal washing with Bérard's machine. The coal selected for the experiments was of a dirty character. There are two separate outlets from the machine—one for carrying away the waste water from the shale or rubbish boxes, and the other for conveying away the surplus water that flows over with the washed coal, and which is afterwards conducted into and through a series of four catchpools before being allowed to run waste. The water in passing through these catchpools deposits the greater portion of the fine particles of coal held mechanically in suspension, and carried over with the water from the machine. The remainder, containing a large percentage of very fine earthy matter, is allowed to escape with the waste water. The following table gives the result of three experiments made with these machines at Park Colliery:—

Date of experiment.	Gallons of water passing through catch-pools per hour.	Coal carried away and lost by waste water. Grains of coal per gallon.	Lbs. of coal per hour.	Lbs. of coal per day of ten hours.	Per ct. of coal lost in waste water.	Tons of coal washed by machine per ten hours.	Percentage of ash in coal deposited in last catch-pool.	Percentage of ash in coal carried away by the waste water.
1870.								
Mar. 11..	6241	1·3·3	92·1	921	0·21	200	10·13	25·91
July 7..	6629	632·9	599·3	5993	1·34	200	10·67	23·44
Dec. 14..	5611	636·0	510·0	5100	1·16	200	(not taken)	29·18

From Oct. 17 to Nov. 19 inclusive the washed coal from the machines was 3577 tons, upon which the cost was as follows:—

All labour	£29	1	5 or 1·95d.	per ton.
Cost of stores for month	2	10	0 or ·17d.	,,
400l. capital, at 20 per cent. for interest and depreciation, one month	6	13	4 or ·44d.	,,
Coal for engine, &c., 30 tons, at 4s. 6d.	6	15	0 or ·45d.	,,
			3·01d.	,,
Add—For loss of coal by washing—say, 9 tons per 100, at 4s.	70	4	0 or 4·75d.	,,
Total cost per ton of washed coal			7·76d.	,,

Of the total quantity of unwashed coal passed into the machine during this experiment the results were:—

Washed coal delivered to coke ovens	90·7	per cent.
Rubbish from rubbish boxes, sent to the rubbish heap (297 tons).	7·5	,,
Carried away and lost by waste water	1·8	,,
Total	100·0	

An analysis of coke made from the same coal before and after wash-

ing, and coked in each case for 48 hours in similar ovens, gave the following results:—

Description of coal from which the coke was made.	Fixed carbon.	Volatile matter.	Ash.	Sulphur.	Water.	Total.
1.—Unwashed small coal (as delivered from colliery)	71·55	3·53	23·21	1·15	·56	100·00
2.—Moderately washed do.	84·37	2·88	11·48	·71	·56	100·00
3.—Well washed coal	91·82	0·04	7·45	·55	·14	100·00

We have, therefore, conclusively established the fact that by washing these coals we obtain an excellent pure coke, containing over 20 per cent. more fixed carbon than in coke made from the unwashed coal.

Mr. TRURAN said that in washing a very dirty and friable coal with this machine, at Dowlais, he found that the washed coal delivered by the machine was only the "rough" small; most of the fine small coal, and fine dirt, passed with the water into the catch-ponds, in the first of which he found good clean small coal deposited, but in the others inferior coal, mixed with a large quantity of dirt and sludge, so that there was a large loss in the process.

Mr. BIRBECK said, in their experience they did not find the fine dirt or sludge deposit to any extent in the catch-pools. After repeated trials they found the small coal deposited in the catch-pools averaged 10 per cent. of ash, whilst that carried away by the waste water, and lost, contained 29 per cent. of ash, showing that the greater portion of the sludge passed away with the water.

Mr. HUXHAM asked whether, in the sample of coke from "well-washed coal," in the analysis of which the fixed carbon is given by Mr. Birbeck at 91·82, any portion of the small coal deposited in the catch-pools was used with the pure washed coal delivered from the machines, and if so, what percentage?——Mr. BIRBECK said the coke giving an analysis of 91·82 of fixed carbon was made from pure washed coal, delivered from the machines, and did not contain any portion of the coal deposited in the catch-pools. The coke showing 84·37 of fixed carbon contained a large admixture of coal deposited in the catch-pools.

Mr. EDMUND asked if the water from the machines carried over any pyrites to the catch-pools, for he would suppose that being heavier than the coal, it would be deposited very soon?

Mr. BIRBECK said, we find that this is so, and that when pyrites is carried over by the water, it is always first deposited in the nearest part of the catch-pool.

Mr. BASSETT said he was using a coal-washing machine at Ashton, and should be happy to place his experience of its practical working before the Institute, and would prepare some particulars for the next meeting. He found the coal obtained from the last catch-pool as good as that in the first, producing a pure coal, and very good coke is made from the washed coal. The cost of labour is about 3d. per ton, and he thought the loss of coal in washing was equal to about 4d. per ton, giving a total cost of 7d. per ton.

The CHAIRMAN said the discussion on this important subject appeared to him to be of a very valuable character, and at this and the previous meeting had elicited much information. They would now proceed to the next paper, "On the Neath Mineral District," by Mr. William Thomas Lewis, C.E., and Mr. Morgan Reynolds. He (the Chairman) said this paper, read at the last meeting, was a very important one. It had not yet been discussed, and in the unavoidable absence of the writers he thought it had better be adjourned to the next meeting.

The next paper for discussion was that of Mr. Thomas Joseph, "On the Changing Character of the Coal, from Bituminous to Anthracite."

Mr. T. JOSEPH (by the secretary) considered that the old and tangible test of the coking character of the various seams of coal, from Tredegar westwards to the anthracite districts, was the best test they could apply in marking the changing character of the coal. And the more that he enquired into the subject, the more he was satisfied of the truth of the theory that he had propounded in his paper—that this great change is the result of magnetic or galvano-magnetic action; and he ventured to predict that upon fuller examination the cleavages in the whole of the beds of the sedimentary formations will be found to be the record of the terrestrial magnetic action of all past time. Eastwards of Tredegar the slip cleavage in the coal is irregular and indistinct, and the whole vertical structure of the coal is covered by the "sulphur gilt." But as we come west of Tredegar, the sulphur gilt disappears in all the lower coals, volatilised, doubtless, by the same action and heat which partially debituminised the coal, and the slip cleavage becomes more regular. The upward gradation of change from the lower to the upper seams of coal, travelling westwards along their northern outcrop, is remarkably uniform; and the disappearance of the sulphur gilt, and successively decreasing debituminisation of the coal, is in exact proportion to the appearance and development of the slip cleavage therein. In fact, the further this question is enquired into and discussed the more, he believed, it would substantiate the theory he had ventured to suggest in his paper, that the measure of the development of the slip cleavage in these coals appears to be the measure or index of the disappearance or decomposition of the bitumen contained in them.

Mr. BASSETT asked if he understood Mr. Joseph to say there was no fire-damp in No. 3 Rhondda seam of coal?——Mr. THOS. JOSEPH said he did.

Mr. W. GABE said he should like to ask the writer of the paper whether the coal, in changing from bituminous to anthracite, was much influenced by the thinning out of the Old Red Sandstone? The author had asserted in his paper that at a certain place the coal changed its character coincident with the thinning out of the Old Red Sandstone; but he gives no reason why such change should take place. The author had previously stated that he considered the whole change took place through some chemical action. He would, therefore, like to hear the author's opinions—1. What connection existed between the change in the character of the coal, and the thinning out of the Old Red Sandstone?—2. At what period or geological epoch, did the change take place? and in what manner did he suppose this change occurred?

Mr. THOMAS JOSEPH said the questions were very proper ones to ask, but he really doubted whether anyone could answer them. He could only say the thinning out of the Old Red Sandstone was coincident with the change in the coal; we cannot go back into bygone ages, nor can we penetrate deep into the earth's crust to watch the great changes of the past, or estimate how they occurred, or at what period.

Mr. HUXHAM said he thought there were many members unavoidably absent that day who would be glad to discuss this questions. It was, moreover, a subject deeply interesting, both in a practical and scientific point of view, and its investigation opened up such a wide field for careful enquiry, that he thought further time would be well spent in its consideration. He, therefore, moved that the discussion be adjourned to the next meeting.——Mr. D. THOMAS seconded the motion, which was carried unanimously.

The next paper brought up for discussion was "On Small Trams," by Mr. T. Burns.

A long discussion ensued upon this paper; the writer's statement that he had effected a saving of 3d. per ton by the use of small trams being closely questioned.

Mr. D. THOMAS brought forward a curious and exceptional case, in which he had worked a seam of coal, having an excellent roof and floor, where in all the level headings he had laid down a 4 feet 8½ inches gauge of tramway, and used trams carrying upwards of two tons of coal. The inclination of the strata was 20 inches per yard, and the coal was delivered by inclines, down into the large trams standing upon the levels. The coal was then taken away, without a second loading, to the port of shipment. Although an exceptional manner of working a colliery, he had found it the cheapest mode, under the circumstances, and compared very favourable in general cost.

The CHAIRMAN said this matter had been well ventilated at several past meetings, when the discussion was first brought on by Mr. Brogden's valuable paper on this subject, and subsequently by the facts, and figures, brought forward by Mr. Murphy, Mr. Holmes, and Mr. Burns. He thought the discussion had elicited many different opinions from various members, and much valuable information. His own opinion was that the form of the tram should be governed by the seam of coal in which it is intended to be used; he thought the small tub tram was not suited for the Monmouthshire collieries, and decidedly not for many parts of Glamorganshire. The great point in South Wales was to produce good large coal, at the least possible cost, and he did not think it possible to effect this by using the small tub trams. In accordance with the wish of the members, the discussion would be postponed until the next meeting.

A paper by Mr. T. DYNE STEEL, C.E., "On the Machinery employed at the Silver Mines of Cerro de Pasco, Peru," then came on for discussion.

The CHAIRMAN stated that the engines were intended to be worked at a pressure of 50 to 60 lbs. per square inch on the boilers, but from a report he had received from the mines he found that the pressure used was only 30 lbs., and that this arose from a fear on the part of the workmen out at the mines that if they loaded the valves to the higher pressure it might endanger the boilers, consequent upon the high elevation above the sea at which they were situated. The result of using this low pressure was a very large consumption of coal per horse-power developed by the engines. He immediately sent out instructions to work the boilers and engines at the higher pressures, and had since received intelligence that the consumption of coal had been reduced by one-half. He was of opinion the high elevation would have no effect in the working of the boilers; he should be glad to hear the views of some of the mechanical engineers on this point.

Mr. HUXHAM said he thought the effect upon the boilers working at such high elevations, as compared with similar boilers working at the sea level, and both equally weighted on the valves, would simply be an additional train thrown upon them, equal to the difference of the pressure of the atmospheric column at the two places.

Mr. H. M. MAYNARD said it would make no difference to the boilers any more than it would in the case of a man working in compressed air, who could go through his respirations, and perform all his duties, even under a pressure of 40 lbs. per square inch, without any detrimental effect. He believed that a boiler ought to work as well on the top of a high mountain as under compressed air.

Mr. MURPHY did not agree with Mr. Maynard that the boiler would not work under any difficulty; nor that men could work under highly compressed air without ill effects. He had seen men brought up, when working under compressed air, at the foundations of the Chepstow Bridge, suffering from bleeding at the nose and ears, and this under pressure of from 20 lbs. to 40 lbs.

Mr. H. KIRKHOUSE thought the boilers would have to bear an extra pressure equal to the difference of the atmospheric pressure on the top of the mountain and the sea level.

The CHAIRMAN said that if the safety-valves were properly adjusted in each case the difference would be accounted for.

A MEMBER thought the outside pressure would have its effect in the safe working of the boiler. Let them suppose an extreme case of two boilers, each loaded to 50 lbs. pressure, and that each of these boilers were enclosed in an air-tight chamber or box; then let them in one compress the air surrounding the boiler to a pressure of 60 lbs. per square inch, and in the other exhaust the air by an air-pump. In the one case the atmospheric pressure outside would be more than the safety-valve was loaded at; in the other, the boiler would have to resist an additional pressure that might impair its safety.

Mr. EDMONDS suggested that the only extra danger or pressure on the boiler was the difference of the atmospheric pressure on the top of a mountain and at the sea level, amounting in the instance cited in Mr. Steel's paper to 6 lbs. per square inch.

Mr. MURPHY had carefully examined the designs of this machinery, and was particularly struck with the great engineering skill and ingenuity displayed in their construction, so as to adapt them for being taken out in small pieces that could be readily carried on the backs of mules up the rough and rugged roads to the top of a high mountain in Peru. It was well worthy the attention of parties who had works similarly situated to avail themselves of the information afforded in this paper. He observed that the fly-wheel of the engine was almost entirely made of wrought-iron, the rim being a wrought-iron box, which was afterwards filled with lead when it had been put together at the mines. There were many other ingenious contrivances in the engines and machinery, and great praise, he thought, was due to the designers.

Mr. EDWIN RICHARDS had not thought they would have been able to get any discussion on this paper. He had never seen any machinery better designed, and he thought the whole of the work was equal to anything that could be done.

The CHAIRMAN said the great difficulty in the erection of the engines was the want of men. There was only one fitter to assist the resident engineer, but they, with the help of the natives, who are as ignorant, stupid, and lazy as can be well imagined, succeeded in getting the machinery put up in as perfect working order as possible, and they were enabled to do this chiefly from the parts having all been so perfectly fitted together before the machinery was sent out.

The SECRETARY then read a paper by Mr. Thos. Joseph, on "Colliery Explosions in South Wales." In this paper the writer says that all judicial and other enquiries into the causes and effects of colliery explosions have hitherto been of too superficial a character, dealing generally with the ordinary condition of the collieries, and circumstances of each case, rather than attempting to grasp the real difficulties of the question, and seek to ascertain the prime cause of such dreadful calamities. He then goes on to state that up to about the year 1845 almost all the large collieries on the fiery seams of the northern outcrop were held exclusively by the ironmasters of the district, who in working the minerals invariably commenced their operations at or near the outcrop, and worked the coals therefrom down to the deep, thereby breaking up and loosening the strata in such a way that it afforded free and natural drainage upwards for the fire-damp liberated in the process of working. Up to this time, and under this mode of working, the writer observes that no explosions involving serious loss of life occurred in the South Wales coal field, which immunity from these dreadful disasters, he considers, arose entirely from the mode of working, giving a free drainage outlet to the gas. After this time numerous large collieries were established, principally on the fiery steam coals, with the pits in most cases sunk as far to the deep of the respective "takings," as circumstances permitted to provide for the effectual water drainage of the property, and to permit the coal being worked as far as possible from the deep towards the rise, which system of working was considered to lessen the cost of production and enhance profits. All the collieries were compelled by the terms of their respective leases, almost without exception, to leave solid barriers of coal all round the boundary of their "takings," so as to separate each by a solid barrier of unbroken strata from its surrounding collieries, and in every case these collieries were more or less isolated, and afforded no free and natural drainage of the gas upwards. The writer then gives abundant statistical returns to show that all the most disastrous explosions that have occurred in South Wales since 1845 have taken place in these isolated collieries where the gas is thus, as it were, pent up. He attributes these explosions entirely to a neglect of natural physical laws in the system adopted of working to the rise instead of the deep, and in opening collieries so placed and shut in, as to preclude a free drainage of the gas. As a remedy, he suggests that in all the collieries working coal of a fiery character the pits should be placed at the highest instead of at the deepest part of the property. That the coals should all be worked by long work towards the deep, or down hill, instead of to the rise, so as to afford as far as practicable a constant upward drainage of the gas. He says that no pillars of solid coal should in any case be left, except sufficient for the support of the shafts. He advocates the upper seams of coal being invariably worked in advance of the lower seams, and thinks it would add greatly to the safety of colliery operations if the tract of coal that each colliery had to work was so apportioned that due regard should be had to the area, shape, or form, lines of faults, or other disturbances, level course, site for pits, &c. And that whilst affording greater facilities to the colliery owners it would at the same time, he believes, ultimately greatly enhance the money value derived from the minerals, and thus directly benefit the landlords; and he sees no reason why such an appointment, so conducive to the general interests of the community, should not form a legitimate subject for legal enactment. The paper, which throughout showed a great deal of careful thought and research, was illustrated by plans, showing the present systems of working contrasted with that suggested by the writer.

A vote of thanks was passed to the writer, and the discussion of the paper postponed until the next meeting.

Time was too short to allow the secretary reading Mr. H. W. Pendred's, C.E., paper on "Wire Tramways," which was very fully illustrated by plans, model, &c., and it was, therefore, taken as read, and its discussion postponed.

After the meeting the members dined together at the Westgate Hotel, being joined by the mayor (Mr. J. Homphray), town clerk (Mr. H. Woollett), and other gentlemen.

THE INSTITUTION OF CIVIL ENGINEERS.

The members of this incorporated society held their last meeting for the session 1870-71, on Tuesday, when the chair was occupied by Mr. C. B. Vignoles, F.R.S., the President. A report was brought up from the council, which stated that during the present month Messrs. Robert Harvey Burnett, John Carruthers, Lewis William Pritchard, and Charles Henry Waring had been transferred from the class of associate to that of member, and Messrs. Thomas Milnes Favell, Joshua Percy Josephson, William Macdonald Matthews, John Narciso de Olano, and William Cort Starie had been admitted as students. The ballot was then taken for the candidates recently passed by the council, and resulted in the election of Mr. Sandford Fleming, chief engineer of the Intercolonial Railway, Ottawa, Canada, as a member, and of Mr. Edward Banfield, manager of the Great Southern Railway of Buenos Ayres; Mr. Peter William Barlow, jun., Westminster; Mr. Walter Brandreth Bromley, assistant-engineer, P. W. D., India; Mr. Charles Toler Burke, Stud. Inst., C.E., assistant-engineer for irrigation, Dhoolia, India; Mr. Jabez Church, jun., Stud. Inst. C.E., Westminster; Mr. Charles John Geneste, late contractors' staff, Delhi Railway; Mr. John Lillywhite, assistant-engineer, Amiralty Works, Portsmouth Dockyard; Mr. Joseph Newton, Royal Mint; and Captain George Swetenham, R.E., late officiating superintending engineer, P. W. D., Hydrabad, as associates. It was announced that during the session just concluded 25 members and 103 associates had been elected, and 50 students had been admitted, while 11 associates had been transferred to the class of member; and there were now on the books 15 honorary members, 732 members, 1061 associates, and 207 students—making a total of 2015 of all classes. It was mentioned that at the same period in 1856, when the institution had been in existence between 38 and 39 years, the gross number of all classes was 797; in 1861 it had risen to 945; in 1856 to 1339; and now it was 2015—an increase of 153 per cent. in the 15 years.

ROYAL INSTITUTION OF CORNWALL.

The spring meeting of the Royal Institution of Cornwall was held at the Museum, Truro, on Wednesday, and was attended with more than ordinary interest and success. The President (Mr. W. J. Henwood, F.R.S.), occupied the chair, and there were also present Mr. Pengilly, F.R.S., Dr. Jago, F.R.S., Dr. Barham, the Rev. J. R. Cornish, secretary; Mr. M. Whitley, assistant secretary; the Revs. E. N. Dumbleton, Dr. Bannister, F.S.A., W. Jago, Saltren Rogers, H. S. Slight; Captain Liddell, Messrs. Augustus Smith, A. Paull, Reginald Rogers, W. C. Borlase, F.S.A., J. H. Collins, F.G.S., J. G. Chilcott, H. Richards, W. J. Rawlings, Freeth, H. James, Job, W. H. Jenkins, R. H. Carter, H. S. Leverton, E. Hawke, and a number of ladies.

The President, Mr. W. JORY HENWOOD, F.R.S., F.G.S., in his opening address congratulated the institution upon the successful progress they had made during the past year. They had not a single loss to deplore, and the numerous volunteers to their ranks prove the increase of general interest in their pursuits, and ensure the usefulness of the institution for years to come. After an interesting literary review for the year, he referred to the presentation of the busts of Fox, Borlase, and Trevithick (all executed by Mr. Burnand); to the discovery in 1866, by Mr. Fox, F.R.S., for the Irish fern, *trechomanes radicans*, in Cornwall, at St. Knighton's Kieve; to the appearance of wild swans in Marazion Marsh; to the valuable researches among Cornish slates, by Mr. John Arthur Phillips; and to the progress made in the trade in various Cornish products.

With regard to the mineral resources of Cornwall, he remarked that the metalliferous rocks of the county comprehended granite, slate, (possibly of more than one period, and sometimes associated with hornblendic rocks), and elvan, which sometimes occurs in isolated masses, but more frequently forms broad, vein-like (courses) dykes, intersecting both granite and slate. Tin ore occurs in granules disseminated through, and in short thin veins intersecting both, granite and elvan, and less mixed with the rock, but aggregated on similar lines, thus forming veinules in the slate. Copper, and several of its ores, impregnate granite, slate, and elvan in much the same manner as tin ore, but far less frequently, and to much less extent. The principal repositories of ores in Cornwall, however, are the lodes, which consist in great measure of quartz; but—extending without interruption through every rock of the metalliferous series, and partaking of the mineral character of each in turn—always contain more or less felspar also, besides other minerals, which it may scarcely be necessary to enumerate here; and, in instances without number, gossan is an ingredient near the surface. The directions of lodes, in different mining districts, are neither perfectly identical nor, owing to slight uncomformable flexures, are those of even the same district strictly parallel. Central parts of the county are, in fact, traversed by lodes of two series—the Champion or Standard, and the Caunter lodes. In almost every case the most highly-inclined portions of lodes are the most productive. It is impossible to overlook the relations which both lodes and cross-coures have to the joints of the rocks they traverse. As a general fact the lodes are wider in slate than in granite, and those of them in which the ores of tin and copper are mixed maintain a greater width than such as contain either ore separately. In some cases the junctions between the lodes and the neighbouring (country) rocks are abrupt and immediate, but frequently they unite by gradual and almost imperceptible transitions; the exterior quartzose portions being generally known as capels.

The proportions of tin and of copper extracted by the smelter from the crude vein-stone broken by the miner have been estimated at 13 to 20 parts in 1000 for tin, and 20 to 21 parts in 1000 for copper. On the shores of Lake Superior considerable portions of the entire breadth of the lode are composed wholly of native copper, which is cut out with (cold) chisels; in other parts mere grains of the same metal are scattered through the lode; in two of the principal mines, however, the average proportions of copper to vein-stone are respectively 0·013 and 0·163 of the weight. At Charnacillo, in Chili, the proportion of silver obtained from the principal mine averages 0·013. In the Ural, the mean proportion of gold in the vein-stone of the oldest and most productive mine, from 1745 to 1841, was 0·000013, or 13 parts in one million. The proportion of gold to vein-stone varies—

	Weight of Vein-stone.
In Nova Scotia	0·000025 to 0·000032
In Virginia	0·000005 to 0·035660
In Brazil	0·000001 to 0·522000
In North Wales	0·000002 to 0·045700

It may not be out of place to remark that the mean produce (percentage) of gold in the principal Brazilian and Uralian mines is much the same; and that, at Gongo Soco, in Brazil, the ore brought to the surface in a miner's hat-cap yielded, in one instance, more than 27 lbs. of gold.

That the parties engaged in any branch of productive industry should know the proportions in which its proceeds are disposed of can admit of no question. Some five years ago his friends and acquaintances amongst the lords, adventurers, managers, and pursers of the largest, deepest, and richest tin, copper, and lead mines wrought in Cornwall during the present century, obligingly furnished him (for another purpose) with accounts of the produce, working costs, dues, and profits of their works. Fourteen of them yielded—

Ores, which realised	£13,158,203
Expended in labour	£7,393,778
Expended on materials	2,288,281
Paid as dues	729,506
Profits to the adventurers	2,756,640 = £13,158,203

The extreme and mean proportions of these several payments are—

	Highest.	Lowest.	Mean.
Labour	0·6357	0·4106	0·5615
Machinery, materials, &c.	0·1592	0·1746	0·1735
Working costs	0·8349	0·4529	0·7330
Dues	0·1860	0·0364	0·0555
Total expenditure	0·9178	0·5033	0·7905
Profits	0·4967	0·0822	0·2095
Total proceeds of ore sold			1·0·00

The following columns show the proportions in which the produce of mines, yielding various metals and ores, is appropriated in different other countries:—

Apportionments.	Mines of copper ore in Devon.	Ireland.	Cuba.
Labour	0·4588	—	—
Machinery, materials, &c.	0·1345	—	—
Working costs	0·5933	0·6115	0·7866
Dues and duties	0·0782	0·0389	—
Total expenditure	0·6715	0·6504	0·7866
Profits	0·3285	0·3496	0·2134
Total proceeds	1·0000	1·0000	1·0000

Apportionments.	Native copper in the United States.	Mines of Silver and its ores in Chili.	Gold in Brazil.
Labour	—	—	0·2950
Machinery, materials, &c.	—	—	0 3460
Working costs	0·6675	0·4239	0·6410
Dues and duties	—	—	0·1026
Total expenditure	0·6675	0 4239	0·7436
Profits	0·3325	0·5761	0 2564
Total proceeds	1·0000	1·0000	1·0000

Regarding both the period and the place at which steam-power was first applied to draining the mines of Cornwall authorities slightly differ. Pryce states that it was introduced about 70 years before (1778) the appearance of his work; Carne gives the date of 1710-14; and Redding a period later than 1720. Carne informs us that the first engine was set up at Wheal Vor, in Breage; Redding states that it was erected at Wheal Rose, near Truro, by his maternal ancestor, Hornblower, a native of Bromsgrove. The differences are immaterial; nor are the means of reconciling them readily accessible. Experiments on the duty of the best (atmospheric) engines were made at Poldice, in 1778, under the superintendence of Boulton, Watt, Tremayne, Williams, and others, and, on an average of two months' performance, it was stated to have been 7,000,000 lbs. lifted 1 foot by the use of one bushel of coal. The record speaks of the bushel of coal as 84 lbs.; but whether in this case it was estimated or weighed is not mentioned. Indeed, the reporters are silent as to the dimensions of the engines they examined. After the lapse of half a century, it is now impossible to realise the intense anxiety which prevailed amongst the agents of mines, and even amongst enginemen, when the monthly report became due; and while several engineers—working in some cases engines of different construction—were striving for the pre-eminence. At one extensive range of mines, at least, it was stipulated that the merchant whose coal failed to perform an appointed rate of duty should submit to a corresponding reduction of price. Throughout the Central Mining district, where the influx of water in mines, worked in the slate series, is greater than in any other part of the county, the enginemen were for many years paid (million money) a few shillings per million for all duty, fixed by the engineer, for every engine. Nor does it seem easy to assign reason for the discontinuance of an arrangement apparently so beneficial to all parties; for the managers of, at least, two of the largest mines in the county found it for their interest to keep the workmen alive to their duty by causing the performance of their engines to be ascertained and written up in the engine-houses daily. Whether borrowed from Cornwall, or determined on independently, he was unable to say; but at Morro Velho, in Brazil, a record of the work done by each stamping-mill is made every day. The influence of engine reports on the duty of engines in Cornwall was considered so beneficial that they were long since adopted in the mines of Flintshire.

As you have on former occasions (continued Mr. Henwood) permitted me to speak of mines and mining, I hope you will not refuse my saying a few words on the mine agent and miner of Cornwall. Mr. Carne—one of the most eminent authorities of a time not long gone by—observed that, "In mentioning the improvements in mining, the increase of mineralogical knowlege amongst the working miners ought not to be omitted. Many of them are no longer satisfied with the common names of minerals, but are now acquainted with the scientific names of the common ores and earthy substances, and even with their constituent parts. Some have gained this knowledge from others, but many possess their systems of mineralogy, which they study at their leisure." Mr. Taylor, who had, perhaps, a more extensive acquaintance with mines and miners in different parts of the world, than any person has had, remarked, "The difficulties of mining . . . call frequently for sympathy and aid. I have during many years had them extended to me by masters in the art . . . . [In] the district in which I have gained most of my experience . . every new invention, and every step in improvement, is freely communicated and discussed; and the most important benefit has accrued in this mutual interchange of knowledge. . . . Cornwall is not singular in this respect."

Mr. Warington Wilkinson Smyth, Chief Inspector of Mines for the Crown and the Duchy, one of our honorary members, than whom there is no higher living authority, eloquently says:—

"Let us not too hastily conclude that men who have not received an education, in the ordinary sense of the word, are wanting in a thorough and satisfactory knowledge of a branch of their own craft. Some among the best of our tinners and pitmen that I have known have been without any knowledge of reading and writing, but whose natural acuteness, joined to constant observance during the experience of years, have enabled them to accumulate a store of facts, and a constantly applicable judgment, which may be envied by those who have been brought up more conversant with paper and print. True it is that their views are necessarily limited—they cannot with safety pass out beyond the confines of their own particular department; and, in most cases, they labour under the disadvantages of neither being able to communicate their experience, nor to rise from their position of workmen to that of managers. Whatever is to be done in the way of instruction, Heaven forbid that anything should interfere with the efficiency of this excellent class of men. As a workman, I believe that our British miner is unrivalled. Let us hope that no undue meddling may shake him in that proud position."

To the opinions of these distinguished men of science I can add that I have seen our countrymen confronted with native superintendents and workmen in many foreign districts, and have invariably found the solution of every intricate problem in mining geology assigned to a Cornish agent, and every task requiring skill, resource, and courage, entrusted to a Cornish miner. I should, therefore, be ungrateful if I were not to acknowledge how materially the judicious advice and cordial co-operation of every class concerned in the mining industry of every country I have visited have furthered my progress in those pursuits which have been my only passport to your favour.

The Rev. J. R. CORNISH read a list of the presentations to the Institution during the past six months, which included a bust of Richard Trevithick, given by Mr. Henwood, one of Mr. R. W. Fox, by Miss Fox, and one of Dr. Borlase, by Mr. Burnard, with other matters by Messrs. Humphry Williams, R. Tweedy, C. Spence Bate, F.R.S., G. A. Copeland, Augustus Smith, and Major Raverty. Mr. Cornish made special reference to the great work of the President on mineral deposits.

The PRESIDENT referred to an exceedingly valuable paper forwarded by Mr. R. Pearse, F.G.S. Mr. Pearse had discovered traces of cobalt in samples of dressed tin from Dolcoath and other Cornish mines. The cobalt occurred in union with arsenic, and in all probability entered into the composition of mispickel or arsenical pyrites. It occurred to him that it would be present in the substance known as "hard head" by the smelters, in a highly concentrated form, and on analysis he found it there to the extent of 4·40 per cent. This subject was worthy of attention, for there was no reason why the cobalt should not be profitably extracted from the "hard head," and the tin saved at the same time.

VENTILATING.—For the purpose of ventilation, instead of exhausting the air as usual in most of the known processes, Mr. J. G. MARSHALL, Holbeck, forces it into the chamber or place requiring to be ventilated by means of a fan or other suitable mechanical apparatus. In doing this he forces the air through apertures in the roof or upper portion of the chamber or place to be ventilated, and lets it escape through apertures in the floor or lower portion of the chamber or place. This mode of supplying air to the room or chamber to be ventilated is combined with a system of circulation of the air through flues, which is effected by the action of the fan or other mechanical apparatus, so as exhaust the air from the lower part of the room, and thus use the same volume several times.

MINING—TECHNICAL EDUCATION.

SIR,—If knowledge is power—and no one disputes it—whatever tends to its propagation must be hailed as an auxiliary of the forces by which the mechanism of events is actuated. But it sometimes happens that its acquisition in one department is made at the expense of another department of knowledge equally, if not more, intrinsically valuable. The miners of Cornwall, and I presume of the other parts of England, if they have not been privileged with a scholastic education in past times, have acquired by concentrated practical effort a knowledge of mining unequalled by any other people in the world. It does not follow, therefore, that a technical education may not improve the Cornish or English miner. Much will depend in this respect on which is made paramount—the practical or theoretical branch of mining knowledge; and much more will depend on the motive actuating the student in "his" application and "its" acquisition. If a profound love of knowledge for its own sake and its utility be the moving spring to its attainment, its acquisition will be because it could not but be, a benefit to its possessor and all his surroundings.

The desire to confer a benefit upon an individual or a community should be accompanied by a knowledge of his or their necessities, otherwise that which was intended to benefit might fail of its object, and, worse still, prove an injury. One of the disadvantages under which the Cornish miner labours abroad—and it is the principal one, much more apparent than real—is, I was going to say a happy, deficiency of that unenviable loquacity which is too frequently nothing better than the tinkling cymbal of an ill constructed and incongruous theory, which his own experience has long since infinitely transcended. I have met with no miners here of the scholastic class, who go about any description of mining work without first indulging in a painful prelude of theoretic travesty, as incongruous in application as it is absurd in proposition. To improve the English miner, his deficiencies must be considered from his own stand-point and surroundings, and everything foreign should be avoided, except for comparison. To remodel the English miners on the basis of any continental system—and it would be useless to look beyond the continent of Europe for any example—would be to turn the tide of mining backward, down the declivity of time, from which it has so slowly but surely ascended.

To maintain his *prestige*—and it is something worth, as well to the world as to the individual himself—his progress should be gradient from its present stand-point, without yielding or digressing in the least to ally himself with or embrace any theory which the circumstances or necessities of his own field of mining does not suggest to his view *en passant*.

It appears to me—and I submit it with diffidence, but deliberation—that an evil besets the technically educated miner, from whatever country, and which he never fails to betray to the keen observation of the practical eye. It is this—inflexibility characterises his theory, as though it were a mathematical theorum, and in practice he arbitrarily conforms thereto, from lack, it may be presumed, of practical judgment. The difference between the theories of book-made practical miners is that the former are abstract in their origin, whilst the latter are analogical.

To educate the mind to thought and observation, and train it in the exercise of devising and applying means to an end, and furnish it with materials to demonstrate beforehand their adaptability, is far preferable as a qualifying medium to become an adept in practical mining, than to load the mind with hackneyed or newly constructed theories, which too frequently from their non-respect of essential differences in their object are incompatible in their application, and ineffectual in their results. I say, and I think all practical men will agree with me, that the miner's education, to be valuable, must be select, and, therefore, limited in a general sense. I do not mean to be understood as aiming to reverse the maxim that a little knowledge is a dangerous thing, by substituting therefor that much knowledge is dangerous to its possessor, but as advocating the application of individual energies to the acquisition of that class of knowledge it can most effectually utilise in subservience of its own interests, and for the good of others. It is well known that the knowledge of the class imparted by precepts is much more abundant than is the wisdom or energy necessary to its proper and, therefore, useful application. It is unnecessary to say that such knowledge, under such circumstances, is no better than tinselled rubbish. It is pertinent to the subject to enquire how far the practical miners—I mean the advanced experienced miners, such as Cornwall and other parts of England produce—have been benefited by the innovations of the *savans* of kindred or associate sciences, except in the most casual and comparatively trivial and incidental way, and which on investigation the most scrupulous candour would admit to be next to valueless. Still this view of the case should be regarded in a stringently qualified sense, as practical skill unaided by science would be equally awkward, blundering, and anomalous.

There can be no question but that the practical man in mining may be largely benefited by his espousal of the included and relative sciences in a more general way than heretofore; whilst, at the same time, a discriminating judgment must be exercised as to how much of the respective sciences would constitute the best and most completely educated mining engineer.

Mechanical science is largely employed in mining pursuits, but who considers it is indispensable to the education of the mining engineer to evolve the design, prepare the drawings, and superintend the manufacture and construction of a steam-engine? His duties are of another kind in this respect—to ascertain the quantity of water, and weight thereof, to be raised from a given depth, subject to prospective progressive increase, as greater depths are reached; to determine the size and class of pumps that should be used, and the horse-power requisite to reach a given depth, with a contingent surface power to compensate for all accidents to the machinery, the pitwork, &c.

There is an essential difference in the education necessary to qualify a mining engineer for home service and that necessary to qualify him for efficient service abroad. In England, where the division of labour is so systematically observed, and no part of the country is unrepresented by skilled workmen, there is scarcely a conceivable necessity that may not be supplied without appreciable loss of time, or material increase of expenditure. Whilst in foreign mining the engineer is not unfrequently thrown on his own resources, and compelled to improvise means to an end, and evoke skilled labour from unskilled hands. In such cases—and they are not exceptional—the individual manager should possess resources within himself equal to what might be represented by a dozen or more departments, professional and skilfully practical at home. It should be borne in mind that very few institutions are equiped for foreign mining like the English. The managerial auxiliaries are wanting, or are too remote to be economically available, and to supply them independently would involve too much expense. I need scarcely say here that one of the most important aids to the miner under such circumstances is a knowledge of practical chemistry, applicable to minerals both in the dry and humid way, and in which the blowpipe is indispensable. It is by these aids that a useful knowledge of mineralogy may be acquired, which, with palæontology, are the most important branches of the combined science of geology to the miner. A knowledge of several branches of the mathematics, including, of course, trigonometry, is also an essential and important part of a mining education, as well as some knowledge of natural philosophy, under which head is included the laws that govern fluid and elastic bodies. Those are the principal branches of science affecting practical mining, so far at least as my experience has extended. When we add to these a competent comparative knowledge of the arts of labour and trade comprised in mining pursuits, it will not, I presume, be difficult to comprehend the care and judgment necessary to be exercised in imparting a technical education to the miner, in order that sound practical knowledge may not be supplanted by that which is purely showey and pedantic.

In this connection I have attributed "art" to labour as well as to trade. In so far as labour is restricted to the underground departments of mining, I deliberately affirm its propriety, as I am quite convinced that in no trade is art in the abstract more exercised than in mining. I have not included assaying in the essential sciences of a mining education, because all that might be required of the mining engineer under that head may be rendered by the blowpipe with practical certainty. Superadded to all the auxiliary branches of scientific knowledge must be the art, or skill, of practical mining itself, or rather preceding or accompanying them, and for which in the main no definite rules can be submitted.

There can be no doubt but that the thoughtful, intelligent, and observant mining manager or engineer is most familiar with his own deficiencies, from the inevitable impulse of felt necessities, arising from embarrassments incident to his practice. To deny this would be to ignore reason, and one of the common instincts of the human understanding—sensibility.

Ought not, then, the fraternity of mining agents throughout the country to avow themselves in a matter so important, and strive to aid in every proper way by their suggestions, prompted by the light of experience, any and every proposition that has for its object the enlightenment and amelioration of the deserving thousands associated with the great national indispensable industry of mining, as well, as in its inevitable tendency it must do, raise and elevate the industry itself from the disrepute and obliquy into which it has fallen, both from inseparably associate as well as from utterly extraneous causes. ROBT. KNAPP.

Eslsworth, Nye Co., Nevada, April 27.

THE FOREMEN ENGINEERS' AND DRAUGHTSMEN'S ASSOCIATION, AND THE PATENT LAWS.

SIR,—I have just read, in the Supplement to the Journal of May 13, the speeches of the members of the above association on the Patent Laws. These gentlemen should bear in mind that since the Great Exhibition of 1851 a vast change has taken place in the commercial world. Prussia, Russia, and America have advanced in commerce and industry to an extent which the people of those countries previous to 1851 little thought of, and we find each year they still continue to get stronger and of more importance. Therefore, in order that England may keep her place among the great nations of the earth, her laws ought to be re-formed to suit the times we live in, and patent laws, for one thing, ought to be abolished. At present a man from any part of the world who finds something new, or, in fact, sometimes only a little improvement, is almost sure to get a patent for it in England, and the consequence is whoever uses that article in England has to pay license to the patentee; whereas in Germany, Russia, and many other parts of the world the same thing can be used, and is used, free of any charge or tax whatever. Therefore, it is quite clear that the more patents granted in England are so many more drags put upon the staple trade and industry of that country, and much to the advantage of foreigners, because, as above stated, the Englishman has to pay heavy license for the use of this patent, whereas the foreigner uses the same thing free of any such charge.

The mining laws of England ought also to receive more attention, for at present the charges made by the lords of the soil on the mine adventurers are often much too high, and a great determent to the welfare of the country. In Germany the dues on minerals are fixed at 2 per cent., and in almost every other country in the world, Great Britain excepted, the dues on minerals are also fixed by the Government, so that the capitalist and miner are not, as in England, entirely at the mercy of the lords of the soil.

A few days since an English gentleman said to me—"I do not trouble myself about English politics, for I invest my money in Prussia and other countries where more freedom and encouragement is given to industry and enterprise." And we know, Sir, there are thousands of other people in England who do the same; therefore, we have undoubtedly a right to ask for reform. I often think it strange that at present, while all other Governments in the world are trying to encourage enterprise and industry in their own land, and thereby to make themselves strong, England and France are the only two countries who manage to drive capital and skilled labour from their shores. AN ENGLISHMAN ON THE CONTINENT.

LEGISLATION ON EXPLOSIVES.

SIR,—I have read the article in last week's *Mining Journal* headed "Legislation on Explosives," with much interest; as also the letters from "Gun-Cotton," John Horsley, and Webb and Co., and the account of the experiments made with the lithofracteur: indeed your impression last week I think we may consider highly explosive. The subject is, however, of very serious moment to all interested in mining, and the only way to get at the real merits of the rival inventions is by fair and impartial trial of one explosive against another.

There is one thing that very frequently is overlooked, except by practical miners—the sort of gas produced by the explosion. This is of vast importance in badly ventilated mines and in close workings. In consequence of the unfair and stringent clauses in the Nitro-Glycerine Bill of last session, the explosives used in mines have been practically confined to the ordinary blasting powder. The inference to be drawn from your article, and from letters that appeared in your Journal several months ago, leaves little doubt but that a Government officer, largely interested in gun-cotton, was the real adviser and promoter of the Nitro-Glycerine Bill; and it would be very interesting to the public, or at least a portion of it, to know how these Government bills are prepared, altered, and hurriedly passed as they often are (and this one in particular), with such outrageous penalties as the liability of a fine of 500*l.*, or 12 months' imprisonment with hard labour, &c.

With all the advantages that the monopoly of gun-cotton for the time produced as a highly powerful explosive over and above ordinary blasting powder, I believe that it has, as a rule, been carefully avoided by miners, and is prohibited from use in some mines from the numerous accidents that have taken place in tamping, and from the suffocating gases evolved when exploded. With regard to dynamite and this lithofracteur, they seem to me to be much of a muchness, both, no doubt, good and useful in their way for quarrying, and of great power. We know that dynamite gives off noxious fumes; the result of an explosion of lithofracteur in close workings *has to be proved*, but if it contains such a large portion of nitro-glycerine as is represented I should fear there would be similar results, though I am told such is not the case.

For the present we know less of Mr. Horsley's patent, but he claims great freedom from this serious drawback, as is certified, I understand, by those who have tried it, and I do not think there can be a doubt from the experiments made that it is an agent of enormous power, and can be used with the most perfect safety.

I, as one largely interested in mining, would suggest that a trial should be fairly made, so that the owners of mines may at once be able to select that which is best adapted for economic mining, not only as regards their pockets, but also the lives and health of those they employ.—*London, May 22.* A MINER.

THE TEN DROPS OF NITRO-GLYCERINE.

SIR,—As the letter of "Gun-Cotton," contained in the Supplement to last week's Journal, is calculated to do Science an injury by misleading many of your readers, I beg to give you the true state of the case, as copied from the *Chemical News* of two or three weeks back. In the laboratory of a Professor of Chemistry on the Continent, some foolish minded youth took it into his head to make an experiment with nitro-glycerine by pouring ten drops of it into a small iron saucepan, placing it on a tripod, and then applying the heat of a gas jet. In a few minutes, as might have been expected, a violent explosion ensued, shivering 46 panes of glass to atoms, and driving the apparatus clean through a brick wall; yet, strange to say, although three persons were present at the time, neither of them were injured, but it might have cost them their lives.

So much for the *exparte* statement of "Gun-Cotton," which is of no practical value whatever on the subject he professes to write so philosophically. Again, speaking in condemnation of certain absorbents, he appears to be practically unacquainted with the powerful effects of alumina and nitro-glycerine, which is the basis of Mr.

Horsley's successful patent for protecting nitro-glycerine. Mr. Horsley appears also to have availed himself of a similar principle in the manufacture of his blasting powder, by using certain vegetable substances of a highly absorbent nature, and in such a fine state of division that no nitro-glycerine can ever run or drain out, and thus the views of your correspondent "Gun-Cotton" have long since been anticipated. MATTER OF FACT.

DYNAMITE.

SIR,—Your correspondent, writing under the signature "Gun-Cotton," refers to the late experiments with lithofracteur as having proved that nitro-glycerine can be so mixed with other substances as to be rendered comparatively harmless, but he enquires whether the mixture is really a stable mixture, and suggests that danger might exist if the nitro-glycerine were to separate from the ingredients with which it is mixed. The question asked will commend itself to your readers as a reasonable one, and we are in a position to give a complete and decided answer to it as regards Nobel's dynamite.

In our letter, which appeared in the Supplement to last week's Journal, we gave an account of the transport from Hamburg to this country of a cargo of dynamite, and of the conveyance of 2 tons of it from hence to the Morro Velho Mines of the St. John del Rey Mining Company, about 320 miles up the country from Rio de Janeiro, and showed that it was carried in every conceivable way—in three different ships, and by railway, by wagons on the road, and on mule's backs over the hills where wagons could not be taken, and all without any accident whatever. This dynamite was imported by us three years since, part in loose powder, and part made up in cartridges of different diameters, varying from ⅞ of an inch to 2 in., and we have some of it now in our possession, and not one single drop of nitro-glycerine has ever exuded from it.

The silica with which the nitro-glycerine is mixed is of a peculiarly soft absorbent kind, and completely licks up the nitro-glycerine, and there is no more danger of the liquid nitro-glycerine separating itself from the powder than of the water used in making bread separating itself from the dough before it is baked; it is, in fact, much more likely that the dynamite would become too dry for use from evaporation of the nitro-glycerine than that the nitro-glycerine should increase in fluidity, and escape from the silica, but it appears to be one of the remarkable characteristics of Nobel's nitro-glycerine that it remains stationary and quiescent to a marvellous extent, and its evaporation, if any, is inappreciable. This is proved by the dynamite now in our possession, which we have had in store upwards of three years, and its retains its original pasty character, and is now as good and effective as when it first came to hand.

Your correspondent openly confesses that he has a predilection in favour of compressed gun-cotton, and prefers it to any form of nitro-glycerine, from which it must be inferred that he has not had wet ground to contend with, or he would soon learn the advantage which dynamite has over gun-cotton. He thinks, however, that if nitro-glycerine is to be used at all it would be better mixed with gun-cotton. In this he is mistaken. The mixture has been tried and experimented on, and is not approved for various reasons, the chief of which is the danger of spontaneous combustion from the gun-cotton.

From the experiments reported in your last impression with lithofracteur, it appears that when exposed to concussion between two pieces of iron, both on the wheels of the truck coming in contact with the lithofracteur on the chain over which they passed, and also on the two iron-plated buffers of the wagons striking the lithofracteur between them, partial explosions took place of those portions only of the lithofracteur which were struck, and that portions of the rest burned quietly away without exploding. It is to be regretted that similar experiments were not at the same time made wtth gun-cotton and dynamite. Until the experiment has been actually made, under precisely similar conditions, it is impossible to say with authority what the consequence would be; but we venture to predict that if any portion of the compressed gun-cotton exploded the whole would, and not the part struck only; and we very much doubt whether any portion of the dynamite would explode, but we may confidently affirm that if any of it did it would not be a greater portion than the portion of lithofracteur. We have not ourselves had any practical experience with lithofracteur, but we understand it to be dynamite, with a mixture of gun-cotton and gunpowder, and as such it stands to reason that it must be more dangerons than dynamite alone, inasmuch as gunpowder and gun-cotton are each of them more dangerous than dynamite.—*Carnarvon, May* 24. WEBB AND CO.

A NEW AND IMPROVED STAMPS.

MORE WORK AND LESS COST.

SIR,—Everyone connected with our Cornish tin mines will readily acknowledge the great advantage, and even necessity, of economising the cost of returning the ores to the greatest possible extent. I have, therefore, much pleasare in informing you that Mr. Samuel Searle, of Sticker, near St. Austell, in the county of Cornwall, an engineer in the above capacity of great experience and skill, who has doubtless raised, as allowed by compentent judges of the highest authority, within the last 14 years the heaviest and best trains of stamping machinery to be found in this county, has invented an improved stamps. I have seen a working model which he has just completed; it will work up to a 20-in. blow, and 60 blows per head per minute, and requires no greater amount of power whatever to lift the same weight through any portion of its stroke than is now employed to do the same thing on the old plan of stamps, as generally used with a 9 or 10 in. blow. Every mechanician will appreciate the value of the increase of the height of blow of the descent of falling bodies; a stroke of double the distance gives four times the weight of blow; consequently, a battery of eight heads, as above described, would be quite capable of doing the work of 40 heads on the plan as generally used in this county up to the present day, and with a saving of 50 per cent. in the cost of the erection of the same to do an equal amount of duty, which commands every consideration. It appears to be a machine that has been closely studied, and every part of it has undergone severe investigation in all its most minute particulars, every head being so constructed that it is quite independent of each other, and any head can be put in or taken out at pleasure, without affecting the remaining portion of the machine, which is a matter of the greatest importance.—*St. Ewe, St. Austell, May* 22. J. MUFFORD.

SOUTH AFRICAN GOLD FIELDS COMPANY (LIMITED).

SIR,—In reply to the letter of Mr. C. L. Griesbach, in the Supplement to the Journal of May 13, I may say he is certainly mistaken on two material points with regard to the Matabili gold fields of South Africa. He says *water and wood are scarce*. Mr. Baines states, emphatically, that near this company's claim on the Simbo River the wood is "inexhaustible," and the water supply good.

I can only suppose, therefore, that your correspondent has never been in the locality indicated; the more so, as the statement of Mr. Baines is substantially supported by Mr. Mohr, the German traveller, who has lately arrived in London, and with whom I have had the pleasure of a conversation.

In the *London Colonial News* of May 13 it is stated that a party of Australian miners at Tatin had obtained from 2 tons 15 cwts. of quartz 17 ozs. 8 dwts. 8 grs. of pure gold; and from another vein, from 2 tons 10 cwts. 2 qrs. 26 lbs. of surface quartz the yield was 26 ozs. 3 dwts. 12 grs.

You may remember that some two years ago scientific men declared positively, at the Society of Arts, that the report of the diamond discoveries on the Vaal River, in South Africa, was a hoax, and that it was impossible the most precious of stones could be present in such bad company as was to be found in the land of the Boers. We may now note the result. When, however, their existence was no longer doubtful, the *quality* of the gems was questioned. I am able to state, on the authority of an experienced practical man, that the Vaal diamonds are, on an average, in no way inferior to those which reach this market from Brazil.

With regard to the Gold question, I am sanguine that the result will prove equally satisfactory to the welfare of those who interest themselves in South Africa; and I think the figures given above, quite independently of the testimony of this company's officers, are sufficient to satisfy all those whose minds are open to conviction.

I enclose the report of our mineralogist, Mr. C. I. Nelson, to the directors. This gentleman's experience of 13 years in California will give weight to his opinion, which is opposed to that of Mr. C. L. Griesbach.—*Threadneedle-street, May* 22. E. OLIVER, Secretary.

GOLD IN SOUTH AFRICA.

SIR,—In the Supplement to last week's Journal Sir John Swinburne replies to my letter which appeared in your much esteemed paper of May 13. As he calls many of my statements erroneous and misleading, I hope, in the interest of truth, you will grant me the space to say a few words in answer to this charge.

In my last letter to you I wished to give a general description of the geological structure of the auriferous regions of South Africa, and how they are situated in a geographical point of view. I have visited most of those localities myself which I had pointed out to you, as for instance the Umzinto, Tugela, Zulu country, the country beyond Sofálla, and the tracts south of Tette and Senna, but not the Tatin. From what I saw I formed my opinion, and still do think that these regions will never be important to white labour, unless the passage through the Zambezi will be found practicable. The tremendous distance of the northern gold fields, which Sir John admits to be about 1200 miles from the nearest approachable seaport, makes it at once unlikely that the northern gold fields will become a second California. The general features of these regions are not promising, and as regards the Tatin, we possess an excellent report from the mining engineer from Freiberg, Mr. Hübner, whose authority I do not venture to doubt, and who shares my opinion regarding the practicability of crushing the quartz so far in the interior. But, of course, Sir John, who modestly leaves the scientific description to "*the professors*," may be in possession of much later discoveries and more material facts; if so, I am open to conviction as regards the southern gold fields at Tatin. I said in my last letter to you that "*gold is undoubtedly there*," and only doubted that the quartz reefs and veins may be worked to advantage; but, of course, if Sir John will kindly inform me how the shares of the L. and L. C. stand, he will, no doubt, convince me at once if I am wrong in thinking so. C. L. GRIESBACH,

Cor. Mem. of the K. K. Reichsanstalt, in Vienna.

FORMATION OF THE EARTH, METALLIC DEPOSITS, &c.

SIR,—Permit me to say, in answer to a letter that appeared in the Supplement to last week's Journal, signed C. L. Griesbach (Cor. Memb. of the K. K. Geol., Reichsanstal, in Vienna), that the communication to which it refers relates only to those sciences which treat of the nature and character of the rocks forming the crust of the earth, and not in any way to the requirements of an educated person, as Mr. Griesbach is pleased to construe it, and whose letter runs thus:—"Under this title Mr. Harris-James, M.E., expresses in last week's *Mining Journal* the wish that the study of geology (as he says of late a very interesting science) should be divided into three distinct parts—chemistry, mineralogy, and palæontology. I do not know how geology was taught in the school where the writer of the said article received his instructions, but I know that everywhere else, especially in the mining academies of Germany and Austria, a student of geology learns, besides the desired 'branches' of geology, a great many other useful things. Amongst them he receives a sound instruction in the principles of physics, one of the most necessary accomplishments of every educated person."

The three sciences—chemistry, mineralogy, and palæontology—to which Mr. Griesbach refers, were to designate the different processes concerned in the production of the formation of the crust of the earth, and by the help of which we have at once the names and natures of those substances forming the rocks of which the earth's crust is composed. It was, therefore, out of place to comment on the science of "Nature" (zoology, botany, magnetism, meteorology, mineralogy, geology, electricity, &c.), which is the general signification of the term physics, the whole science of which may be divided into two heads—concrete physics, and abstract physics. The former comprises descriptive theology. The latter treats of mechanical philosophy, including under it mechanics, hydrostatics, hydraulics, &c. To the latter, perhaps, Mr. Griesbach wishes more particularly to refer, so that he may touch upon his mechanical philosophic capabilities in also concocting a theory of the earth's formation.

J. HARRIS-JAMES, M.E.

Grampound Road, Cornwall, May 23.

COPPER AND SILVER MINING ON LAKE SUPERIOR.

SIR,—Winter seems at last to withdraw its icey hand. We have had an exceedingly mild season, neither cold or stormy enough to suspend outdoor work for a single day; but for all that, the cold weather has hung on with a tenacity rarely witnessed here. Navigation may be said to be opened, although there is no through traffic, the repairs on the Saut Ste. Maria Canal preventing the passage of craft until the 1st May.

People on Lake Superior are looking for better times than have been experienced for some years past; especially is this so in the copper region. We have no lively times, nor is there any unusual excitement, but the feeling is gaining ground that the copper mines, after all, can be profitably worked, under ordinary circumstances. The results obtained from the mines at work during the past year have done much to bring about this feeling; and when I say that the dividends made in that time have been sufficient, after deducting assessments called in the same period, to pay 5 per cent. on all the capital subscribed from the commencement of mining operations in the copper region, those most acquainted with mines will readily understand why holders should have confidence in their property. The mines, on the whole, are looking better than a year ago, and increased dividends may, with a fair price for copper, be looked for.

The Heela and Calumet Mines have recently been consolidated. They are making immense profits—unitedly, not less than $150,000 per month. The product of these mines for March amounted to 821 tons of 80 per cent. mineral, and it is only a question of increased stamping power to further increase the returns. They are sinking under the sixth level, and the conglomerate is reported to be as rich as ever in these most important points. This company is about to experiment with the "Diamond Drill," with a view to using it in their openings. The "Burleigh" is already at work in more than one mine, so there will shortly be an opportunity to compare results.

The Quincy Mine continues to do a good business. They are taking out from 120 to 130 tons of copper monthly. Last year they cleared a profit of $150,000, the mine looking well for the future.

The Pewabic and Franklin Mines, on the same lode, and adjoining the Quincy, are being worked on tribute. The companies failed to make them cover expenses, and let both concerns for a year to one individual, at 1-6th tribute. He works them as one concern, and makes a profit for himself and the companies. Nothing has been heard of improvements in the mines since the introduction of the tribute system, and it is to be hoped that the profits made are not at the expense of the constitution of the "Balls." This, however, is a question that concerns none but those interested, and if the mines are left stone-blind, neither the tributer nor the public are to blame.

Other mines in the Portage district are being worked on a small scale by parties of tributers, who it is to be hoped will keep them moving until the companies may see fit to work more extensively.

In Keweenaw county there is no material change. The Cliff Company is about ready to commence stamping their burrows, the accumulation of 20 years, on a large scale. This proved to be a profitable business last year, and proportionably better results may be expected in future. It has been expected that the company would explore other parts of their large property during the coming summer, but nothing definite is known among outsiders as to their intentions. They have just declared a dividend of $10,000.

The Phœnix, as the best mine in the county, should be considered as the most important; they are making large returns, the mine being rich, and it is considered that they must be making large profits. Dividends have been expected, but for some publicly unexplained reason have been deferred.

The Copper Falls and Central Mines are about the same as for some time past; the former divided $20,000, and the latter $50,000, on last year's work.

In Ontonagon county, the Ridge is the only mine working by a fair force of miners. That mine is reported looking well, but they have confined themselves more particularly to pushing the openings, consequently the returns have not been large.

The Minnesota and National Mines are being worked on tribute. These mines are regarded as being worked out, and it is impossible to conceive of a more effectual method of obtaining the last pound of copper than to turn in a lot of "old hands" on tribute; neither the men nor the companies have reason to complain of the winter's work.

I would, before closing, refer to the silver mines of the north shore. The parties in charge of the work on Silver Island were for many years engaged in the copper region, where they now have many friends; through these important and reliable information have been obtained during the winter. The vein continues as rich as ever in sinking; and although only 14 miners have been employed, they have $400,000 worth of silver ready for shipment. The truthfulness of these statements will be tested in a few days. One of the steamboats that has wintered on Lake Superior has to-day gone across the Lake, carrying a party of gentlemen, familiar with mining in all its branches, some of them having spent more than 20 years on the Lake. This boat will take down the silver, so that there need be no exaggeration or doubt as to the real merits of the discovery. It is almost needless to remark that this is causing quite an excitement, and great expectations are formed as to the amount of work that will be performed this summer. The mine at work is owned by Americans. Is it not strange that while any amount of British capital can be found to work mines in the United States, none can be diverted to the equally rich fields of enterprise that are lying dormant in Canada? It will be interesting to observe the results obtained from the trial of new stamping machinery in Cornwall. Any number of experiments have been tried on Lake Superior mines—none with so much success as Ball's stamps, and this is only adapted to the stamping of coarse sand. At the Hecla they stamp through grates of ½-inch holes, and put through 110 tons of hard conglomerate per day per head. A stamps on the same principle, though different somewhat in construction from Willoughby's new patent, was tried last season at the Schoolcraft Mine. They succeeded in stamping 5 tons of rock per cord of wood consumed, as against 10 tons with Ball's stamps. The designer has not given up the hope of successfully competing with anything in the country; but it is a fact that they have not retained the machine at the Schoolcraft, though in want of more stamping-power.—*Keweenaw County, Michigan, U.S., April* 25. MINER.

COPPER MINING ON LAKE SUPERIOR.

SIR,—There is little of interest to report. As a general thing our copper mining interests are drooping, the product being mostly from eight or ten of the richest mines of Lake Superior. These produced last year about 13,000 tons of ingot copper, against 12,000 tons the year previous. At this date, and for some time past, our market has been inactive. About a month since 3000 tons of ingot were sold in New York, for June, July, and August delivery, at 21 cents per lb.; since then no large transactions, and retail lots are sold at the same price.—*Congress-street, Boston, May* 8. C. EMERY.

THE BRAZILIAN GOLD MINING COMPANIES.

SIR,—A few days since I had a copy of the Taquaril monthly report sent me, also a copy of Capt. Treloar's report on it in reply to the letter sent to him, requesting an explanation of the reports from the superintendent as compared with the opinion officially presented to the board by Capt. Treloar after having inspected it with a view to its purchase. He then reported very favourably, and said he had completely changed his opinion as to the relative value of rock and jacotinga gold mines from the date of his previous inspection of the same property, made by him on account of the St. John del Rey Company, and that he now considered from his experience of jacotinga mines, and from what he had seen of the Taquaril, it was a very valuable property for mining purposes, and recommended its purchase. It was purchased on his recommendation, and after he had been paid for inspecting it with that object in view.

Then he was offered the appointment of consulting engineer to the new company, but refused until he had his own son appointed superintendent; that was done, and they took office. Every report which came home was more encouraging than its predecessor until the gold was actually reached, and then both Capt. Treloar and the superintendent reported on it as being likely to become one of the richest mines in Brazil, and the prospects of the company very dazzling, Capt. Treloar saying there was tangible evidence of its riches, and the lodes were large and well defined. Such reports came once or twice, then there were mysterious telegrams of the results not, perhaps, coming up to the expectations of the shareholders, and this went on till the directors sent for an explanation: this came per last mail, and must have taken the directors by surprise, as it has done many unfortunate shareholders, who, relying on the original report as to the value of the property, and also influenced, perhaps, a little by the remark of Capt. Treloar in one of his reports on one of the Brazilian companies, that "he could not see why mining should be a greater risk than any other commercial undertaking," purchased shares in this and other companies with which he is connected.

Now, it appears to me a more lame attempt at giving an explanation of his original report as compared with the results can hardly be conceived. He says he has been misinformed on the subject, and wrote his opinion on the Taquaril (when sent by the St. John del Rey Company) in conformity with the information he had received respecting it, and did the same when the present company sent him for the same purpose. I would respectfully submit is it allowable that a company should employ a professional mining engineer to visit a property, *inspect* it, and give his opinion as to its value, and after reporting on it as a good investment, and it is found to be *utterly worthless*, that he should turn round and say—"Oh! I reported on it on the word of people who said they had known it at the time it was working, and that it was left in a condition likely to be as profitable now as it was when the old company stopped working it." What, I ask, would be thought of the architect whom you employed to examine a house, and who, having reported that it was a strong, well built house, and only required a few repairs, should, when it had been purchased, turn round and say—"I have been deceived; I was told it was substantially built—I find it is not so, but, in fact, seems on close investigation to be a wreck, and had evidently been painted, &c., to cover its defects from an intending purchaser?" And this I hold is very like the state of affairs as respects the Taquaril Company and Captain Treloar. He professes ignorance as to whether the superintendent has bought and sold shares in this company, but I suppose it is taken for granted he has, and if he has is it to be allowed that Capt. Treloar is to advise the purchase of a property of which he virtually confesses he knew nothing from his own professional knowledge, and that he should secure his own appointment as consulting engineer, and his son as superintendent, besides other relatives in other departments, build a casa grande, a doctor's house, &c., and incur all the expenses which have been done, and still retain his appointment?

No doubt the directors will take steps to reduce the establishment as far as can be done consistently with giving the mine a further trial; but I would submit, is it necessary to have a consulting engineer at all, and is it necessary to keep a doctor for such a small establishment? Capt. Treloar says he retains the confidence of the Chairman; I do not know whether it is so or not. I know he has forfeited my confidence, not only in the Taquaril affair, but also in the Rossa Grande. I would like very much to know if it is true that the Rossa Grande has a doctor on its list of officers as the Taquaril has? and why medical attendance cannot be provided by the nearest Brazilian town or village until the companies are in a position to pay for a European doctor? Many of the employees of the Taquaril live in Sabara, where there is one of the best medical men in Brazil. I would also like to know if a doctor has been appointed to the General Brazilian Company? and what need there is for a consulting engineer and a manager?

I hope the directors will cause a searching investigation to be made into the whole of this disastrous affair, as Capt. Treloar's report or explanation is highly unsatisfactory. Any old woman could have gone out and collected reports from loquacious Brazilians on the subject as well as Capt. Treloar; and if prospectuses are to be issued on such groundless tales, the sooner the public are aware of it the better. AN INVESTOR.

THE DEVON GREAT CONSOLS.

SIR,—At the late annual meeting of this company the Chairman of the local committee is reported to have said that he had no desire to interfere with the earnings of the working man. Having made this statement, his word as a gentleman must, of course, be accepted, so far as his individual responsibility is concerned; and it will be regretted that one of such a magnanimous disposition should have identified himself with a movement having for its object a general sweeping reduction, from the board of directors to the daily labourer.

To prevent anything in the shape of concealment or subterfuge, now that the matter has gone so far, it is but just that the whole truth should appear, and that a direct interference with the working man was also intended can, without the least difficulty or doubt, be proved to demonstration at any moment, if required. A. B. C.

May 24.

CASTLE AN DINAS TIN MINE.

SIR,—As I stated last week, I was gratified with the perusal of Mr. Henwood's faithful and clever report on this mine in the Journal of May 13; and as mine reports are frequently such hollow and deceptive things as to be unfortunately but little relied upon, I have ventured to trouble you with this communication, lest Mr. Henwood's report should undeservedly be consigned to the same category. I will state, then, that being in Cornwall some short time back, I chanced to visit this Castle an Dinas Mine, and can now bear testimony to the truth and correctness (so far as my own knowledge and experience goes) of all that Mr. Henwood has said concerning it; and I will add that I was much pleased with all that I saw there, and that there were evident and substantial traces of a large and rich course of tin ground.

I like the company for the quite, unobtrusive manner in which they have gone to work—no flourish of trumpets, with puff, gongs, and cymbal accompaniment,

but for settling down quietly to their task with the settled purpose of laying open a mine. It is only surprising that the mine has not been introduced sooner to public notice; but I suppose it is owing to the fact, as I learnt when there, that it belongs to a few local shareholders, and I suppose on the principle that "good wine needs no bush," so a good mine needs no push, and the adventurers being as Cornishmen usually are, shrewd and keen in matters stanniferous, like to hold on to that which is good.—*May* 23. THOMAS BREWER.

THE GOBBETT TIN MINING COMPANY.

SIR,—I have read in the Journal a very ample advertisement of the Gobbett Tin Mining Company. I believe the list of subscribers will be closed to-day therefore no motive can be attributed to me if I write a few words in commendation of this undertaking. The space I can hope to receive from you this week literally only admits of a few words, and, with your permission, I will next week return to the subject. Permit me, however, now to say, as a writer on geology and mineralogy well known to you, that the district in which this mine is situated is in all respects such as to favour the expectation of a good return of tin. There can be no geological phenomena more certain than those which point to the existence of this metal, and in this locality undoubtedly there is a rich matrix. The topography of the vicinity of a mine may greatly facilitate operations, or absolutely preclude them. In this case, topographically, everything is favourable. The metal can be got at, and removed at a reasonable cost to emporiums where the value can be received. The company has secured the best engineering advice, the best practical mine management, and with great economy the most competent commercial management in London. The shares must, will go up, and this mine prove to be— A HAPPY ADVENTURE.

[For remainder of Original Correspondence see to-day's Journal.]

DEVONSHIRE GREAT CONSOLIDATED COPPER MINING COMPANY.

The more than usual interest felt in the annual meeting of this company (which was fully reported in the Journal of May 13), in consequence of the opposition displayed by a small section of the shareholders, induces us to subjoin the directors' supplementary report appended to the ordinary balance-sheets and statements of work done, especially as from the large number of details given it will be of much interest beyond the immediate circle of shareholders in the mines:—

A SUPPLEMENT TO THE DIRECTORS' REPORT.

In reference to certain observations made by a shareholder at the annual general meeting of the Devon Great Consols Mining Company upon the alleged exorbitant salaries paid to the agents, the directors feel it is due, not only to themselves, but also to the agents, to point out to the shareholders, and especially to those who were unable to attend the meeting, the important duties that devolve upon them, for which they do not receive more than a just remuneration, including the advantages of coals, candles, and house-rent allowed, and which is even less than that of the agents of some neighbouring mines. The directors, moreover, think it right to state they have just received a memorial signed by seven of the married agents of the company, in which they solicit a restoration of the rate of payment which they received before the reduction took place last year, as they find it is impossible to provide for their families, and maintain a position of respectability with their present salaries so long as the high price of provisions exists. The directors regret that this memorial did not come to hand in time for the meeting, as, in their opinion, it would have been a good answer to the complaint that the agents were extravagantly paid. In confirmation of the fact that the agents are far from being overpaid, the memorandum herewith has been drawn up, showing the duties required of them, and describing the extent of surface, the number of shafts, length of levels, the winzes and rises opened out in the mines, also the steam-engines, water-wheels, pitwork, man-engines, &c., all of which the directors think cannot fail to be interesting to the shareholders, and which they trust will be sufficient to convince them of the necessity of a well-paid and efficient superintendence over such a large and important property. A comparison was attempted to be made with the cost for agency at the South Caradon Mine. If the extent of surface occupied by the Devon Consols Mines, and the number of tons of ore sampled be taken into account, the directors are prepared to prove that these mines are worked at a less cost for agency than the complainants' model mine of South Caradon. The directors have the pleasure of announcing to the shareholders that they have received advices of an improvement in the lode at the Railway shaft on the new south lode, which is now worth fully 20 tons of ore or 80*l.* per fathom. In conclusion, the directors beg to repeat that they are always pleased to receive suggestions from shareholders—to all of whom the books of the company are at all reasonable times open for inspection—which can be proved to be advantageous to the company, but they never can countenance an unnecessary and ill-advised agitation which, instead of promoting its interests, tends to lower the concern in the estimation of the public.—W. A. THOMAS, Chairman.

MEMORANDUM OF WORKS DONE AND ACTUALLY BEING DONE IN THE MINES.

Number of shafts by means of which the underground operations throughout the mines are carried out	18
Number of shafts now being sunk	3
Total depth of shafts now being worked, as above	2381 fms.
Total of pitwork actually in course of working	2173 fms.
Man-engines—one at Wheal Josiah, 144 fms., and one at Wheal Emma, 205 fathoms	2
Length of drivages throughout the mines, 23,938 fms.	Total
" winzes and rises " 5,410 fms.	31,519 fms., or
" shafts " 2,171 fms.	36 miles nearly.
Length of tramways underground, 4720 fms., or	5½ miles nearly.
Steam-engines employed constantly 8, and 1 occasionally during the summer months, when the water falls short in the Tamar	9
Large wheels for pumping, and several smaller ones for hauling stuff, &c., throughout the mines	6
Length of rods at surface	2140 fms.
Length of railway from arsenic works to Morwellham floors	5 miles.
Length of railway for bringing stuff from the Railway and Agnes shafts to Wheal Anna Maria dressing-floors	1 mile.
Locomotives	2
Inclined planes leading from the main line of railway to different parts of the mines, viz.:—	
To Wheal Emma (a double line)	Total
To Saw-mill	length of
To Wheal Anna Maria engine	549 fms.
Ordinary inclines planes, from Hitchins' shaft to Richards' shaft, from Richards' shaft to dressing-floors, from head of Wheal Anna Maria floors to crusher, and from Wheal Emma upper floors to crusher, a total length of	443 fms.
Total length of tramways at surface, or dressing-floors, &c.	1648 fms.
Total length of dressing-floors	240 fms.
Arsenic Works—Area	7 acres nearly.
Including five calciners, three refineries, 4805 ft. in length of flues, or over three-quarters of a mile, the working capacity being 87,395 ft., arsenic mill, driven by water-wheel, spacious stores, coopers' shops equal to the production of 15,600 barrels per annum, changing-house for men, &c., the works altogether being capable of producing	per annum.
Laboratory for analysis of all ores going to the arsenic works, and from different parts of the mine in connection with the underground workings.	2500 tons.
Length of mines from the western part of Wheal Maria to the extreme limits of the sett eastward, through which the explorations have extended, and through which from one end to the other there is uninterrupted communication	2180 fms., or 2¼ miles.
Total number of people employed underground, 337; ditto at surface, 553	890
Number of places working underground—viz., shafts, winzes, rises, and drivages	60
Dock and floors at Moorwellham to be kept in repair.	
Length of leat (width 18 ft.) to the large wheels to be kept in repair, 2 miles; length of upper and other leats, 4 miles	6 miles.
Monthly returns of ores Tons	1413
" " arsenic	178
" carriage of coals, timber, iron, &c.	527
" " ores and mundic from Bedford Mine	82
" " coals, &c., to ditto	4 — 2204 tons.
Superintendence of ores at quays, dividing, weighing, &c., weighing after sale.	
Superintendence of foundry.	

The agents are required to be on the mines on all occasions throughout the year, commencing at 5 o'clock on the Monday mornings, for the delivery of materials, candles, powder, and other requisites. To attend daily at 6 in the morning, and again at 10 o'clock at night, to see the men down and up to and from their different places of work, in addition to their daily duties underground. Two agents to watch from Saturday evenings until Monday mornings, and in case of accident (which must occur occasionally in the extensive range of machinery throughout the mines), the other agents are called upon to assist if required. To attend at the monthly sampling, which sometimes happens on the measuring day at the mines, on which occasions the measurements underground have to be made before leaving the mines. Two locomotives to be kept in repair. All the machinery throughout the whole of this great range of mines, both at surface and underground, to be kept in thorough repair. Railway wagons to make and to be kept in repair. Manufacture of coke for foundry, locomotives, and arsenic works. From the great width of the lodes, and the dangerous nature of some portions of the ground, great care and attention are at all times required in connection with timbering of the underground workings, in order that the mines may be kept well open for advantageous working, and ensure safety to the men. At the reduction works, from the nature of the different processes, the furnaces require to be kept at work both night and day, and strict supervision is at all times necessary, in order that no loss may accrue (especially in the production of the pure arsenic) from inattention or neglect on the part of the men engaged in the works.

MEMORANDUM OF DUTIES OF AGENTS.

UNDERGROUND AGENTS.—Daily visits to, and monthly measurements of, 60 bargains, including shafts, winzes, rises, and stopes, extending from Wheal Emma to Wheal Maria—a distance underground of nearly 2 miles, and the superintendence of pit and timbermen, and 72 trammers, fillers, and landers, besides the care of the machinery underground and at surface throughout the mines during the year, including Sundays. On duty throughout the year from 6 o'clock in the morning until 10 o'clock at night.

SURFACE AGENTS.—Superintendence of dressing departments, the dispatch of all the ores from the mines to the quay, and the receipt of coals, timber, and all other materials therefrom, the superintendence of smiths, carpenters, sawyers, masons, enginemen, labourers, and the foundry and railway. Dividing and weighing the ores at quays, and constant attention to the precipitate and arsenic works. Attendance in case of breakages by night or day, the receipt and delivery of stores on Monday mornings at 5 o'clock, and on all other mornings at half-past 6.

UNDERGROUND AND SURFACE AGENTS.—Attendance on the mines from Saturday evenings to Monday mornings, attending to leats, watercourses, and machinery, including steam-engines, water-wheels, and lines of rods, with various other incidental duties throughout the year.

NEW COAL PAINT.

The inventions of Mr. DAVID BARKER, of Northfleet, for the utilisation of small coal have frequently been referred to in the *Mining Journal*, and it appears that in the course of his researches to find a suitable waterproofing material for his blocks of compressed fuel he discovered that a valuable varnish-paint could be produced by taking equal parts by weight of the refuse of coal tar oils remaining after the distillation or treatment of the latter for the production of carbolic acid, or naphtha and pitch, or other equivalent substance, and combine therewith about seven and half parts per cent. of common salt. These ingredients are then mixed with water, and the whole boiled together. The water and salt in solution are then drawn off from the pasty mass which has resulted from the operation of boiling, and a quantity of fresh water is added to the latter. The mixture is boiled, allowed to settle, and the water drawn off. The mass may then be boiled or heated a third time, but this is rarely necessary, and if considered desirable sulphuric acid or other suitable drying agent may be added thereto. The proportion of common salt above-mentioned is that which he prefers, and which he finds most advantageous in practice, but it may be used in equal proportion to the other ingredients, and caustic soda may also be employed in the same proportion as the common salt, and either separately or in combination therewith.

The solid portions of the refuse matter mentioned is by preference used for the purposes of the invention, and when the compound resulting from the treatment above described is in a pasty or solid state the requisite amount of fluidity is obtained by heat, or the admixture therewith of turpentine, or other solvent possessing properties analogous to those of the solid substances employed. The compound obtained by means of this invention may be used alone as a varnish or preservative coating, or pigments or colouring matters may be combined therewith, but such pigments or colouring matters need only be employed for colouring, as the compound itself possesses sufficient body, and the use of white lead or other analogous body colour, and also of linseed oil, is rendered altogether unnecessary. As it is stated that the new paint can be supplied to the consumer at the rate of 6d. per gallon, there is little doubt that it will come extensively into use. The value of paints of this kind for the protection of iron from rust is well known, and as the rust, in fact, combines with the varnish, and forms a part of the paint itself, there is not even the necessity for cleaning the iron before applying it.

NEW ALBION TELEGRAPH, AND DUST-PROOF COLLIERY SIGNALS.

Every invention calculated to be of service to the mine and colliery proprietor by giving him increased facilities for working his business is a fit and proper subject for the *Mining Journal*. It cannot be denied that an agent by means of which a man can become ubiquitous is one that affords "increased facilities," since it entirely meets that oft-spoken excuse and oft-desired power expressed by the phrase—"Well, I can't be in two places at once." The electric telegraph virtually enables a person to be at a great many places at once, and those who have the control of a railway know very well that the telegraph system places them in a position to make their presence felt at every station on the line to which the wires are extended.

Private telegraphs are now very generally adopted by merchants, manufacturers, and others having two or more places of business, and they are unanimous in bearing testimony to their value. They say it brings everything, as it were, under one roof, and distance becomes of no object. It is as easy to control the business 10 miles away as if it were only next door; and if the mills are far apart one counting-house serves for both. Next to the metropolitan police telegraph, the most extensive system of private telegraphs to be found in use by any one firm is that of the Wigan Coal and Iron Company. Close to the manager's room at Ince, near Wigan, is the private telegraph office belonging to the company, and in which are eight or ten instruments, and a large supply of battery power. Some of these instruments are of the class known as single-needle, some are the alphabetical or A B C instruments, by Wheatstone, and some consist of bells only. They can communicate by means of these to all parts of their extensive works, and also to Liverpool, Manchester, and Preston. At the two former towns the system is farther extended to eight or ten offices, or depôts, in the suburbs, making about 20 stations, and employing more than 60 miles of line wires. This serves as a good illustration of the utility of the private telegraph; and, in recommending its general adoption, it is with pleasure we now call attention to a new alphabetical telegraph instrument, called the "Albion," invented by Messrs. JOHN BAILEY and Co., of Salford, and specially designed for mining and colliery purposes. It is exceedingly strong, being encased in heavy cast-iron boxes, faced with polished brass rims. The dials are of porcelain, with black letters on a white ground, and these cannot become tarnished, but are always clear and distinct. It is simple to work, requiring one hand only to actuate the current and indicate the letter; and, while free from liability to become disordered, can easily be repaired by any village clockmaker. This, then, is just what is wanted for mining use—that is to say, where any distance separates the works, and where the telegraph operator may be a working man, whose strong hand, hardened by daily toil, would very soon break an instrument that was made for lighter use.

Messrs. Bailey and Co., whose name is very familiar as manufacturers and patentees of many useful inventions, have produced several novelties since adding to their business that of electric telegraph engineers; and this department of their business, though only started at the commencement of the year, is actively employing a large staff of workmen, in an extensive range of workshops, erected in the rear of their old-established Albion Works. They have an electric dust and damp-proof bell for outdoor and subterranean use, and several most ingenious contrivances for signalling on one wire Up or Down the line, one way only, without breaking the continuity of the wire from end to end. Also a signal or automatic contactor, for indicating (no matter at what distance, for distance is no object), the maximum and minimum height of water in a reservoir or of gasholders, a bell ringing loudly at any given point.

Another invention, of which Messrs. Bailey and Co. are sole manufacturers, is Mr. Louis Crossley's electric speed indicator, by means of which the exact speed of any number of engines, the working of hoists, &c., can be shown at any distance, so long as they are attached to the conducting wire. Mr. Crossley is the well-known electrician and meteorologist, of Warley Hall, near Halifax; and by means of this electric indicator is accustomed to register, at his residence, the velocity of the wind at the top of the lofty Beacon Hill, that rises over the town some miles away. We have thought engravings of the "Albion" telegraph and the dust-proof signal to be of interest to our readers, and purpose giving one of the electric speed recorder or indicator, with a detailed description, in a future issue. In a catalogue now in the press, Messrs. Bailey and Co. devote eight pages to illustrations and quotations of telegraph apparatus and materials, forming the most complete *repertoire* of such a description yet compiled. It will be useful to the tradesman and interesting to the amateur, and a guide to everyone connected with railways, telegraphs, collieries, and mines. We wish them success in their new undertaking, and that their fame as electric telegraph engineers may equal that which has already preceded them in other useful inventions.

ELECTRO PLATING INSIDE OF LEAD PIPES.—By the invention of Mr. H. E. TOWLE, New York, to coat or line a long length of lead pipe with silver, the pipe is first made straight or nearly so, and placed on a table inclined at an angle of about 20° or more. An anode of peculiar construction is next inserted within the pipes at the lower end; the negative pole of a galvanic battery is attached to the pipe and the positive pole to the interior anode of silver. The pipe is next filled with a solution of silver (cyanide of silver in a solution of cyanide of potassium, for example) at the lower end, so that it will not quite reach to the upper end of the anode; the anode is then slowly drawn forward and the lead pipe is occasionally jarred or rolled over to bring its sides alternately uppermost. The time required to complete the coating will depend upon the thickness of the coating desired, the electrical force of the battery, and the character of the solution employed. The anode of silver to be adjusted is made of silver, and consists of a rod of metal (or a tube) insulated by washers of india-rubber, gutta-percha, glass, porcelain, or other suitable material, so as to keep the metal ingot at about equal distances in every part from the lead pipe. In using expensive solutions, it is preferred to attach to the lower end of the anode or ingot an India-rubber hollow cone, filled with dry sponge, which when dipped in water expands and forces the sides of the rubber against the pipe sufficiently tight to prevent any of the solution from leaking past it as it is carried forward with the anode. A copper wire, insulated with gutta-percha or otherwise, is attached to this ingot or anode, for the double purpose of conveying the electrical current and moving the anode within the bore of the pipe.

ELECTRO-MAGNETS.—By the invention of Mr. E. W. ANDREWS, Englewood, soft iron core is used within a short helix, forming a single spool electro-magnet. This iron core is attached at one end to a permanent magnet, of a shape to pass up at the side of the helix, and extend towards the exposed end of the core, and upon this end of the permanent magnet is a hinged tongue; hence by induced magnetism in the core and tongue from the permanent magnet, the tongue is attracted by the core. An adjustable spring is applied to the tongue, but it is not sufficiently powerful to separate the tongue from the core. The coil of the electro-magnet is wound so that a pulsation of electricity will give to its core an opposite polarity to that of the induced magnetism from the permanent magnet; hence a very slight pulsation of electricity through the electro-magnet will cause the breaking of contact in the tongue and core, and the cessation of that pulsation allows the tongue to be attracted to the core. The secondary local or relay circuit is broken and closed by the motion of this tongue, an insulated screw being placed with its point just clear of the tongue on the opposite sides of the same to the core, and the secondary or relay circuit wires being connected to this screw and to the bed carrying the permanent magnet

ON MACHINERY EMPLOYED AT THE SILVER MINES OF CERRO DE PASCO, PERU.

BY MR. T. DYNE STEEL, M. INST. C.E.

[Read at the South Wales Institute of Engineers.]

Cerro de Pasco is situated on the Andes Range of Mountains, in South America, at an elevation of 14,500 feet above the sea level, and about 150 miles west from Lima. The town contains some 20,000 inhabitants, all more or less connected with the silver mines of the neighbourhood. Callao is the shipping port for Lima, Cerro de Pasco, and the adjacent district.

The bridle road or mule track between Lima and Cerro de Pasco, is the only route whereby goods or machinery can be transported, and this limits the weight and size of every package to a single mule-load. The maximum weight is 300 lbs.; it is preferred by the mule drivers to take two articles of 150 lbs. each, which may be slung on either side the mule, to one weighing 275 lbs., because the mule thus carries his load more easily, and the difficulty of loading and unloading is vastly diminished when light packages are carried, and this is an important consideration, when it is borne in mind that several days must be occupied in the journey. The cost of mule carriage from Callao to Cerro de Pasco is about 25s. per kilo, equal to 3*l.* 15s. per mule-load, or 27*l.* 10s. per ton. The nature of the country is, of course, extremely difficult for the transport of materials, and at one point of the route an elevation of 16,000 feet has to be surmounted, and at several places the mule track will admit of only a single mule passing at a time. Cerro de Pasco is almost the centre of a rich mineral district containing copper, lead, and silver ores in abundance, the latter metal is that chiefly worked; the other two, owing to the difficulty and expense of land carriage, are of comparatively little value. Coal of a bituminous character is found a few miles from Pasco, and is carried by llamas, driven in droves like sheep, each llama carries a kilo or 100 lbs. of coal. The cost of coal delivered at Pasco is about 2*l.* 10s. per ton. The climate is remarkably healthy, extremes of temperature are unknown, but constant and rapid changes take place, snow and sunshine alternately, the former rarely lies upon the ground more than a few hours at a time. Thunderstorms of a violent character, but of short duration, are frequent. The barometer stands without much variation at 17·30 to 18 in., which gives an atmospheric pressure of 8·5 lbs. per square inch, as against 14·7 lbs. at the sea coast. Water boils at a temperature of 186° Fahr., or 26° below the boiling point at the sea level, and in consequence it takes five or six minutes to boil an egg.

The two principal argentiferous veins of this district, cross one another at the town of Pasco, at an angle of about 70°, the first runs from north to south, to an ascertained length of at least 3500 yards, by 130 yards wide; the other runs in a west north-westerly direction, the length has been traced 2100 yards, and breadth 126 yards; from these main arteries smaller veins branch off in all directions. The silver mines are mere surface workings, more like enlarged rabbit warrens than anything else; some of them are entered from surface holes, often covered by the miner's hut, and from holes excavated on the premises of the mine owner. The mining is done exclusively by the natives, a diminutive race of Indians; the ore, which is something like brown gravel in appearance, is brought to the surface on the backs of Indians in leather bags or skins. Europeans or natives of the coast are incapable of prolonged exertion in the rarified atmosphere of Pasco; a difficulty of breathing effectually prevents any such active exertion as men are accustomed to in localities of moderate elevation above the sea, the level of Pasco being within 500 feet of the summit of Mont Blanc. The ore contains from 30 to 80 per cent. of silver, the richest mines of the locality are at present drowned out, and a company has been formed for the purpose of draining the lower parts of the veins, where ores of great richness are known to exist. The Pasco mine owners are, therefore, looking forward to a prosperous period, should the pumping company prove a success.

Some time ago, an iron bucket is said to have been fished up from one of the old shafts, coated with silver like thick electro-plate.

The ore, when brought to the surface, is deposited in a heap near the mines, preparatory to its undergoing the first process, which is grinding by immense edge runners of granite 8 to 10 feet diameter, by 18 to 20 in. wide. These stones are brought a distance of about 60 miles, over a very rough country, in a singular manner: the stone is dressed at the quarry, and a spindle hole made in the centre, into which a strong beam is inserted, a small wheel is then fixed on the opposite end of the beam; and the apparatus thus formed is drawn across the country by 15 or 20 oxen, over hill and dale, progress being made by bringing forward the large and small wheel alternately. Each of these stones will last six to eight months, it is by that time reduced in diameter to 5 feet, when it is taken out and made into a bottom stone or saucer. The cost of the stones is a very heavy item in the expenditure of the hacienda or establishment, the value being about 80*l.* each. The ore is ground in the saucers by the edge runners till it is sufficiently fine to flow away into receivers with the water which is allowed to overflow the rims of the saucers; a constant stream of water is poured into the saucers from a pipe while the grinding is going on. After the ore is ground as described, it is taken to circular yards called circos—these are shown on drawing No. 1, which is the ground plan of the hacienda. The residence of the managers, the offices, stores, &c., are at one side; the engine, boilers, and grinding apparatus, occupy the centre, and the circos, of which there are 61 in this establishment, are on the other side. These circos are about 36 feet in diameter, paved with stone, and enclosed by a dwarf wall from 3 feet to 3 feet 6 in. high. The ore after grinding is spread over the floor of the circos to a depth of some inches, the whole is then dosed with salt, lime, quicksilver, copperas, and water. Eight horses or mules are brought in, and driven round and round to mix the whole up together; the driver stands on the centre stone, shown on the general plan No. 1. This process is continued during 30 or 40 days, the stuff is then washed in a running stream between the circos, in which pots are placed at intervals to catch the metal. When collected from the pots it is filtered through large cone-shaped bags slung from the roof of the buildings; the bulk of the mercury is by this means made to drain off into vessels placed to receive it. The residuum is turned out on a skin-covered table, and formed in moulds into brick-shaped cakes, which are piled up on the floor in the form of a cylinder, and covered with a wrought-iron bell, like a boiler dome, a charcoal or coke fire is built round the bell, and the quicksilver remaining in the amalgam driven out by the heat drops into receptacles placed beneath to receive it. The remaining silver, which has a porous and beautifully frosted appearance, is taken to the smelting-house, assayed, and run into bars of 100 lbs. each for the market. The machinery employed at the mines is chiefly for grinding the ore, and it will be understood from the foregoing sketch of the several processes for reducing the ore (into the silver of commerce) that the first or grinding process is of considerable importance.

The hacienda Esperanza is the only establishment in Cerro de Pasco in which steam-power is employed; all the other haciendas have their machinery driven by water-power, grinding machinery of the same kind is used in all, the only difference being in the size of the establishment, and the motive power in use.

Several years ago an engine and boilers were erected at this hacienda; it was a beam engine, and of sufficient power for the work that was ultimately put upon it. Badly erected in the first instance, and overworked, the owners determined to replace it by a new engine, boilers, and driving gear, and in November, 1868, Messrs. Steel, Rake, and Co., of Newport, Monmouth, were instructed to design a new engine and machinery, which resulted, after mature consideration of the subject, in the pair of engines and boilers shown on the drawings Nos. 2 and 1A. The horizontal form of engine was adopted because the several parts could be better arranged to meet the requirements as to weight for transport, and this form being well adapted to the work to be done, which, as before described, is principally driving edge runners for grinding the ore. Ten of these stones, 10 feet diameter, from 18 to 20 in. wide, are driven from a line shaft by straps, the stones make 10 to 12 revolutions per minute; they are fixed to a spindle working in a vertical slot close to the upright shaft, driven by bevil gear, as shown on the drawing. The stones have all to be

started at once, and the engine is required to move them slowly at first, to prevent the straps being thrown off the pulleys. The stones are subject to be brought up short when the saucers are over-loaded with ore, and for this reason straps are found more convenient than gearing for communicating the motion, and breakages are, therefore, prevented.

ENGINES.—The engines are made with reversing gear, to facilitate the release of the stones when jammed, and for putting on the straps. The bed-plate or frame of the engines is of wrought-iron, of box girder form, the top plate ¼ in. and sides ⅜ in. thick. Angle iron 2½ × ⅜ in.; the rivets are countersunk in places where the different parts of the engine are fitted. Cross girders connect the beds, and they are further stiffened by wrought-iron struts. The girder for carrying the outside end of the fly-wheel shaft is also of the box form, 10 in. wide, by 9 in. deep, top plate ½ in. thick, and sides ⅜ in. The cylinders are each made in three rings, accurately fitted and bolted together; the joints are bored and turned, and make a steam-tight joint iron to iron, the parts of the cylinder are bolted together by eighteen ¾-in. bolts in each joint. Tie rods 1¾ in. diameter are fixed from the cylinders to the crank shaft plummer blocks, to stiffen the frame and steady the engine. These rods are in two parts jointed at the centre, where they are supported on cast-iron brackets. The pistons are Wilson's patent, two rings in each; the piston rods work through both ends of the cylinders in the usual manner. The valves are worked by four eccentrics and link motion; for forward and backward gear, a reversing lever and notched guide are fixed at the side for arranging the cut-off according to the load upon the engine. The steam pressure at the boilers is 50 lbs. per square inch. The cranks are of hammered iron connected by a short shaft. A drag link is placed between the crank and fly-wheel shaft, in case the shafts should settle out of line, and to lessen wear and tear and shocks to the engine. The fly-wheel shaft offered the greatest difficulty in bringing down the weight to the requirements, and this was accomplished by making it in two parts and forming solid flanges next the fly-wheel. The centre or boss of the fly-wheel, which is of cast-iron, is bolted through to the flanges, as shown on the drawing No. 3, and forms the continuation of the shaft through the wheel. The fly-wheel is of wrought-iron, the rim being a circular box girder, filled with lead at its destination—the crank balance is produced by filling part of the space with wood; the arms are solid hammered iron, tapered from 2½ to 1½ in., as shown on drawings Nos. 3 and 3A. The engine frames are bedded on solid masonry, no timber of sufficient size for sills being obtainable at Pasco.

BOILERS.—The boilers are each 20 feet long by 6 feet diameter, with two tubes 2 ft. 4 in. diameter, in each tube there are four Galloway tubes. A steam dome is fixed upon each boiler, 3 feet 6 in. high by 2 feet 6 in. diameter, the shell and dome plates are ⅜ in. thick, end plates ½ in. thick, tubes ⅜ in. thick.

GEARING.—The spur wheel and pinion are made in parts to suit the weight. The centre piece of the spur is made in two parts bolted together, as shown on drawing No. 4, the rim is also in two parts, the rim and centre piece are bored and turned and accurately fitted. The diameter of the spur is 3 feet 9¾ in. on the pitch line with 50 teeth. The pinion is made in two parts, as shown on drawing No. 5, the diameter on pitch line is 2 feet 2⅞ in., 30 teeth. The centre piece and rim are jointed in a different manner to the spur, the joining flanges overlapping and bored and turned. The shafting is of the usual description, and needs no special remark, it is described on drawing No. 6. The shaft C has an arrangement for throwing the pumping pinion in and out of gear; a long key way is cut, and a key fitted long enough to allow the driving pinion to be moved on the shaft so as to clear the wheel, the pinion is retained in either position, by sliding collars fastened by set screws. The speed of the engines, 44 revolutions, is slow for engines of this class, quick-speed engines could not be maintained in efficient repair, where skilled labour is not to be had except at enormous cost, and for this reason a moderate speed of piston was determined on. The boilers were punched and put together at the makers, then marked and taken apart and rivetted at their destination by men sent out for the purpose; the fly-wheel rim, bed-plate, girder, and pumping beam, were treated in a similar manner. The boilers are supplied by a No. 7 Giffard's Injector. A force pump is attached to the engine, for use in case of necessity. The boilers are set in masonry, a peculiar fire-stone is found in the neighbourhood, superior to the best fire-bricks made in this country. A pump drawing water from a well, for the supply of the hacienda, is worked by the engine, by means of spur gear and a wrought-iron beam, shown on drawings Nos. 7 and 7A.; this arrangement is only temporary, as it is intended to obtain water from a lake about half a mile from the hacienda, and for this purpose 5 in. pipes were sent out, cast by Spittle, of Newport, each 6 ft. long, and weighing only 70 lbs. each pipe, so as to make a mule load of four pipes, bundled two and two; the thickness of the pipes was about 3-16 in. The writer had one of the pipes tested at Mr. Spittle's works to a pressure of 650 lbs. per square inch without bursting it, a fact which speaks well for the founder.

The contract for the engines was let to Messrs. Kitson, of Leeds, the boilers to Messrs. Galloway, of Manchester, and the shafting gearing, &c., to Messrs. Stothert and Pitt, of Bath. The whole of the work where fitting is required, is made to Whitworth's pitch. The total cost of the whole delivered in Liverpool, was 1100*l.*; the cost of shipment and land carriage to Pasco about 1200*l.* The whole of the machinery arrived at Cerro de Pasco in good order, with the exception of one boiler plate, which with the mule carrying it went down a precipice into a river; the mule was, of course, never seen again, but the boiler plate was ultimately recovered after an interval of some months during the rainy season, not much the worse for its fall. The engines were started in a very satisfactory manner on August 10 last, and they have since driven the 10 edge runners and the pumping engine continuously, with great care and regularity.

It will, perhaps, be remarked that the processes for reducing the ore are of a rude description, and this is undoubtedly the case. The difficulty and expense of introducing anything new or unusual into this region is extremely great, chiefly owing to the wonderful stupidity and ignorance of the native Indians, who are capable only of doing the commonest labour; they are, in fact, little better than beasts of burden. Europeans have to be sent out expressly to erect machinery, and the cost of passage out and home, the high wages paid—12s. per day, to fitters, masons, and smiths—and the difficulty of controlling these men where there is no competition, offer serious obstacles to improvement. Again, the enormous cost of transport, which is about equal to the total value of the machinery in England, is sufficient to deter any but enterprising and energetic men of capital from undertaking any outlay outside the beaten track traced by their predecessors.——A vote of thanks was passed to Mr. Steel for his paper, and the discussion was adjourned.

THE NESQUEHOMING TUNNEL—THE BURLEIGH DRILL.—It is not generally known that a tunnel which, for scientific engineering and economy, speed and durability of work, is not surpassed by the Mont Cenis or Hoosac tunnels, is being driven by the Lehigh Coal and Navigation Company, of Pennsylvania. Although little known by the public, engineers of celebrity state that the science of tunneling is here illustrated under the most perfect conditions, and that the record of the work is eagerly examined by experts, both here and in Europe. The work was at the beginning prosecuted by hand drilling, but as soon as the Burleigh drills were introduced they were adopted after trial, and went into operation March, 1870, since which time they have given great satisfaction. The tunnel is driven through the coal measures, cutting each vein known in the region, and after passing through them it penetrates an intensely hard conglomerate, leaving which it enters red shale. A brief description of the Burleigh drills used will be interesting. The drills are driven by condensed air, which is pumped by six 20-horse power steam-engines into a large iron receiving tank, from which it is conducted into the tunnel through a six-in. pipe of cast-iron, and is distributed by hose to the three carriages which support the drills. These three carriages support the drills used for the heading and the first and second enlargements. The heading carriage supports five drills, the first and second enlargements each having three. Motion is given to the drills by the action of condensed air in the cylinder, the piston of which is connected directly with the drill. Their working is far superior to that of any previous process, a 3-in. hole having been driven in sandstone in eleven minutes, while the average progress in the hard conglomerate rock is 7 feet per hour. The heading is now in the red shale, and is proceeding at the rate of 35 ft. per week. Work is soon to be prosecuted from both ends of the tunnel, and boiler and blowing engines are erected and in readiness at the north portal. When under full headway, about 60 ft. per week will be made, and at that rate the two headings will meet in September. The enlargements follow upon the heading, and it is expected that trains will run through by January, 1872. The work, when completed, will save great expense and delay in moving trains on the Lehigh Navigation Co.'s roads, and will be quite as much an object of curiosity to tourists as was the Switchback Railroad, which has been visited by many thousands.—*Iron Age* (New York).

METALLIFEROUS DEPOSITS, AND UNDERGROUND TEMPERATURE.

An abundance of observed facts is essential to the formation of any theory on which reliance can be placed, and for this reason, if for no other, the value of such works as that of Mr. W. JORY HENWOOD,* just issued, is almost inestimable. The author, as well as possessing the advantage of sound scientific training and extensive practical experience as a miner, is fortunately enabled to write with authority upon the facts he records from having actually visited and resided in the localities to which those facts relate, so that the value of the information he furnishes is beyond question, whether it be estimated for its scientific interest or for its utility to the practical miner in assisting him to conduct his business successfully. For thirteen years Mr. Henwood has been engaged in the production of the volume, which is scarcely surprising when it is considered that it treats of mineral deposits in India, Chili, Brazil, the United States, the Lake Superior district, New Brunswick, Jamaica, Spain, France, the Channel Islands, Ireland, Scotland, Wales, and Cornwall, and that the object of his memoir is "to describe deposits of iron, copper, lead, chrome, cobalt, nickel, silver, and gold associated with rocks of different ages in various parts of the East and West Indies, North and South America, and the continent of Europe; to compare them with such as yield both similar and different ores—especially the ores of copper, lead, and tin—amongst formations of less varied composition in the West of England; and to trace the local peculiarities which, in subordinance to general laws, have determined their distribution.

With reference to Kumaon and Gurhwal, in North-Western India, he shows that the granite of Dwarra Hath, Almora, and Deo Dhoora, although surrounded by metalliferous rocks, is itself barren. The micaceous, talcose, and chloritic slates are interlaid by various ores of copper at Kurrge, Rai and Bellar, Goron, Seera, Pokree, and Al Agur, and with iron ores at Sahloo, Agur, Suttea Garh, Burma, Shealgarh, Guarcoolee, Lusghanee, Nutoa Kanh, Galla, Dhoora Kanhi, Capua, Choocoota, Purturbura, &c. The talcose and clay-slates at or near their union include conformable beds, charged with copper ore, at Seera and Pookree. The clay-slates of Pahlee, Pahlee in Kalee Kumaon, Mungla Lekh, Tilpoora, and Simul Khet contain similar deposits of iron ore, and in the same series graphite is obtained at Dol. Clay-slate and calcareo-siliceous breccia are separated by a band of iron ore at Burrulgaon, and the same breccia, together with a calcareo-siliceous conglomerate by which it is succeeded, are overlaid with similar iron ore at Rampoore. At Khuloa-garh and Hurchinolee calcareous slates are charged, and at Tutyl they alternate with iron ore. In the calciferous slate and siliceous limestone of Dhunpoore the ores of copper are mostly determined to the joints. Calcareo-siliceous rocks are impregnated with copper ore at Taragke-tal, and with the ores of iron at Oojowlee, Kyrolee, and Patol. The quartz rocks which prevail near the junction of the Khurna with the Kosila are largely associated with iron ore, and siliceo-ferruginous conglomerates appear at Jham, Bejapoore, Loha, Bhabur, and Dechowree. Limestone is overlaid by sandstone at Bhamouree. Beds of pebbles and gravel occur far above the reach of neighbouring streams near Dwarra Hath and Nehal-bridge. In similar, though in thicker, deposits on the low grounds many small rivers disappear; after considerable courses beneath the detritus they re-appear at the surface. Siliceous sand and granitic gravel are slightly mixed with gold in the beds of the Ramgunga, the Alnknunda, and the Pindur. The operations of native miners in the Himalaya are in the last degree rude, ineffective, and costly; fire is applied to the rocks, to aid the operations of the workmen, and torches of resinous wood are used to light them at their labours. Attempts to introduce systematic mining have been made by the Government, but without success. The furnaces, bellows, and other appliances of the native iron smelters are beyond measure rude and inefficient; moreover, their charcoal, made of the softest wood, is inadequate to producing the requisite heat. Both the produce and the refuse of the furnaces are divided in recognised proportions amongst the farmer of the revenue, the miner, the smelter, and the charcoal-burner.

In Bengal the gneiss of the Rajmahal is succeeded by quartz rocks at Fitcooree, and these by siliceous sandstone containing carbonaceous matter and nodules of iron ore at Jherria. Masses of conglomerate and of amygdaloidal trap overlie the sandstone, and a seam of coal crops out in the same neighbourhood. Iron ore occurs both in nodules and in the joints of sandstone near Taldanga; and on the opposite side of the Barrukkar thin layers of similar ores interlie a body of shale. At Akysa and Barrul Cajoor heaps of slag show that iron was formerly smelted in the neighbourhood.

The details connected with the mineral deposits of India are followed by an elaborate account of the Chanarcillo und Copiapo districts of Chili, to which reference will be made in a future notice, and we have then a series of very interesting chapters on Brazil. The richest part of the province of Minas Geraës, situated between Congonhas do Campo on the south, Candonga on the north, tributaries of the river Doce on the east, and the Rio das Velhas on the west, is about 100 miles in length, and from 50 to 70 miles in width. That portion of it which consists of undulating table land and rounded hills, some two or three thousand feet above the sea, is covered with coarse grass (*capim gordura*), the rest, which rises into serrated ridges and isolated peaks five or six thousand feet high, is in many places still clothed with virgin forests. The auriferous series is made up of granite and gneiss, overlaid by micaceous and talcose slates, which are sometimes interlaid by quartz rocks mixed with mica and talc. The micaceous and talcose slates are succeeded by clay-slate, which passes at times into chlorate slate, and often includes large masses of quartz. The clay-slate is followed sometimes by an inconsiderable deposit of granular quartz and calcareous matter, but far more frequently by thin bands of specular and oxydulated iron, which commonly alternate with granular quartz (itabarite), and are at intervals mixed with the ores of manganese, as well as with talc and mica (jacotinga). In some cases, however, the clay-slate is not easily identified. The granite of Candonga contains gold alloyed with palladium, but that of Caraca and of Caethe is barren. The quartzose talco-micaceous slate is often interlaid, and occasionally intersected, by bodies of quartz; these at Santa Rita, Rossa Grande, Catta Branco, Paciencia, and Coelho, are of widely different dimensions, and contain unequal proportions of gold, beside smaller quantities of iron pyrites, and the ores of antimony, bismuth, and tellurium. Quartz rocks of granular structure are at Catta Preta, traversed by vein-like masses of crystalline quartz, which mostly conform to two series of joints, but frequently ramify, and sometimes enclose horses of granular quartz. The crystalline portions are traversed in all directions by short joints, which are often lined with red iron ore, sprinkled with granules of gold. The clay-slate contains many auriferous beds, which conforming to its cleavage consists at Tijuco of spheroidal and angular bodies of brownish quartz, and at Ouro Fino of globular masses of iron pyrites, and of slate enveloped in quartzose slate and colourless quartz. At Gongo Soco (Camara) short interlying beds of quartz and earthy brown iron ore either dwindle or disappear in the rock, or terminate at its joints.

At Morro Velho the metalliferous deposit, coinciding sometimes with the cleavage, frequently with the joints of the rocks, but often oblique to both, assumes the character of a bed in some but of a lode in other places; both its course and its dimensions are, therefore, irregular. It consists in great measure of quartz mixed, however, with great quantities of iron pyrites, and with arsenical pyrites, yellow copper ore, and other minerals in smaller proportions; these ingredients embed considerable quantities of slate, mostly microscopic, but occasionally in bodies of large size; their structure is generally, but not always, coincident with that of the neighbouring (country) rock, which also they commonly resemble in composition, yet many of them are mixed and transfused with siliceous and pyritic matter; a thin half-inclined tongue of killas separates the principal formation from the north branch, a somewhat similar one beneath it; in both the shoot of the several ores coincide with flexures of the adjoining strata; between the country and the veinstone there is not uncommonly a gradual transition, but beds, and even laminæ, of the former sometimes protrude from the walls, and either partially or entirely sever the latter. All these veinstones, as well as the rocks which bound them, are more or less auriferous, but the pyritic portions are by far the richest; even in them, however, an admixture of other minerals would seem necessary to their productivenesss; moreover, at various depths veinstones of different hardness afford gold in unequal proportions and dissimilarly alloyed; silver, however, is always the principal alloy.

From this sketch of a portion of its contents the general character of Mr. Henwood's book will be readily understood; it contains precisely such particulars as the geologist and the practical man would like to possess. Every care has evidently been taken to ensure the greatest possible accuracy, and in order that the reader may be in possession of the views of all the principal authorities who have been over the same ground, Mr. Henwood very freely extracts from their writings the passages directly bearing upon his statements, inserting these extracts as annotations to his own record. The work is rendered very complete by the insertion of no less than 37 elaborate tables, and of an abundance of wood-cuts to facilitate the ready comprehension of the facts recorded.

The work is indeed a valuable addition to our scientific literature, and will long enjoy an honourable place amongst the most esteemed works bearing upon geology and mining.

* "Observations of Metalliferous Deposits." By WILLIAM JORY HENWOOD, F.R.S., F.G.S., &c. "Observations on Subterranean Temperature." By the same author (forming the Eighth Volume of the Transactions of the Royal Geological Society of Cornwall). Penzance: William Cornish, Green Market.

FOREIGN MINING AND METALLURGY.

The German iron trade maintains a favourable aspect. All the various establishments possess sufficient orders to keep them employed for the time, and if the railway companies do not delay too much in giving out their orders the rolling-mills will soon be overdone with work. But to secure this result the prompt re-establishment of general order is indispensable, as without peace and tranquillity the railway interest will be in no hurry to construct new lines. The price of iron has continued to advance, buyers showing a favourable tendency. In consequence of a good demand for iron minerals in the Siegen district an advance has steadily continued in prices.

The Belgian iron trade continues in a relatively satisfactory state, the products of the blast-furnaces being disposed of regularly and promptly. There is not much change to notice in affairs. The Marcinelle Metallurgical Company (MM. Cornil, Dupret, and Co.) are about to light shortly a blast-furnace of large dimensions. The report of the Charleroi Chamber of Commerce states, with reference to the iron trade of that district, that the first half of the year was generally a favourable period; orders were abundant during the whole time, and the works maintained a great activity, running off their products at remunerative rates. The war which broke out in July brought a downward tendency in its train; prices have again, however, revived this year. The production of pig in the Charleroi district last year is returned at 327,743 tons, as compared with 307,446 tons in 1869, and 265,580 tons in 1868. In last year's total casting pig figured for 30,520 tons, and in that of 1869 for 19,642 tons. The production of iron in the district last year was 283,495 tons, against 261,938 tons in 1869, and 180,746 tons in 1868. The total number of workmen employed in the iron trade of the Charleroi group was 10,609 in 1870, as compared with 10,607 in 1869, and 8628 in 1868. The iron trade of the district would seem, then, to have progressed, upon the whole, last year, in spite of the war.

The exports of coal from Belgium have been on a rather more considerable scale of late. Numerous orders have been received from France, but the events which have been passing in Paris have, of course, greatly interfered with deliveries to France. Happily, according to all appearances, the insurrection in Paris is drawing to a close, and the restoration of tranquillity in the great capital is expected to involve a marked revival of activity in the Belgian coal basins. The deferred requirements of consumption are probably large, and the stocks which have been for some time accumulating in Belgium will probably rapidly disappear. The stocks in the Couchant de Mons at the commencement of this month were estimated at 4,220,000 hectolitres, or 1,850,000 hectolitres more than at the corresponding date of 1870. The report of the Charleroi Chamber of Commerce for 1870 has just appeared, and states several interesting data. The report calls attention to the unfavourable influence exerted by the Franco-German war upon the Belgian coal trade. If at first sight, observes the report, some advantage may appear to have resulted to the collieries of Belgium from the enforced idleness of the German coal trade, this advantage has been only of short duration, and it has also been of little importance, since the want of railway plant almost always rendered it impossible to execute the orders received on a large scale from Germany and Holland. The report further complains that the railway companies and administrations do not turn to full account such railway plant as they have at their disposal; and it calls for a direct railway from Charleroi to Athus, which would carry the coal of Charleroi to the blast-furnaces of the Grand Duchy of Luxembourg. The report also solicits a prompt completion of the Charleroi girdle line. The number of collieries in activity in the Charleroi district last year is returned at 53, as compared with 52 in 1869; the number of working centres in activity was 107, against 106 in 1869. The total number of workmen employed at the collieries amounted last year to 34,818, against 34,212 in 1869. The extraction effected last year was 5,513,450 tons, against 5,496,720 tons in 1869; the augmentation observable in the production occurred entirely in the first half of the year. The amount paid in wages in the Charleroi district last year was 1,270,520*l.*, showing some little increase as compared with the corresponding total for 1869; the other miscellaneous expenses presented, however, a reduction last year.

Advices from Westphalia state that an advance in the price of coal has given some animation to the collieries of that basin, but they require, nevertheless, a general peace, which can alone induce capitalists to embark freely in industrial pursuits. When a general peace is at last realised, a splendid future will, probably, open out before coal mining industry in Westphalia and the Rhenish provinces. Never was the state of affairs so propitious for such a development as at the present juncture. Although exorbitant rates for coal are at an end for the present, still prices remain at a remunerative level, and coalowners have no grounds for apprehending a want of outlets; on the contrary, the demand is active, especially for long-termed contracts. What German coal mining now requires is plenty of capital, and a liberal supply of railway plant, and both these desiderata will, no doubt, be secured with a general peace.

The French copper markets have presented very little more animation. At Havre, Chilian and Peruvian, in bars, have been quoted, however, at 66*l.* 16s. to 68*l.* per ton; refined Chilian and Peruvian, in ingots, at 77*l.* to 80*l.*; pure Peruvian minerals, at 70*l.* to 72*l.*; United States (Baltimore), 76*l.* to 78*l.*; ditto, Lake Superior, 80*l.* to 86*l.*; and Mexican and La Plata, 66*l.* to 68*l.* per ton. The three latter quotations are, however, only nominal. At Marseilles, Toka has made 68*l.*; Spanish, 70*l.*; refined Chilian and Peruvian, 72*l.*; rolled red copper, in sheets, 78*l.*; and round ditto, 82*l.* per ton. On the German copper markets transactions have become rather more numerous, although prices have not experienced great variations. At Rotterdam prices have not varied; Russian crown has made 50 fls.; and Drontheim, 50 fls. to 52 fls. Tin has almost entirely made default at Havre; at Marseilles, Banca has been quoted at 140*l.*, and English at 148*l.* per ton. At Rotterdam tin remains in much the same position, without any great transactions being noted; Banca oscillates between 75¾ fls. and 76 fls. Some lots of Billiton have given rise to some purchases at 74¾ fls. to 75 fls. For deliveries in the autumn there are buyers at 73 fls. At Havre soft Spanish lead, first fusion, has been dealt in at 18*l.* 16s. At Marseilles, lead in saumons, first fusion, has brought 17*l.* 16s.; second fusion, ditto, 17*l.* 8s.; and lead, in shot, 20*l.* 8s. per ton. At Rotterdam, Stolberg and Eschweiler are quoted as hitherto at 11 fls.; and German of various marks at 10¾ fls. At Marseilles, zinc in plates, re-cast, has made 19*l.* 4s.; and rolled ditto, 28*l.* per ton, with a discount of 3 per cent. In Germany zinc has experienced scarcely any change.

A NEW GOLD-SAVER has just been completed by Messrs. Thom and Allen, at the foundry in this city. It is called Johnson's Batea Separator and Amalgamator. It receives the pulp as it comes from the battery, and is designed to save the powdered mercury and gold which escape from the coppers of

the battery. The machines are made of cast-iron, are five feet in diameter, and are covered with sheet copper. The pulp is discharged in a basin in the centre, and flows over upon sheets of copper sloping towards the circumference of the machine. While this is being done, the machine is kept in motion about the same as a shaking table, causing a friction of the amalgam against the copper plates, and the gold escaping from the battery is caught. Should any quicksilver escape by passing over the plates, it is caught by a gutter of sheet-iron, which runs around the rim of the machine, while the water and sand flow over, passing into a sluice arranged to carry them off.—*Nevada Transcript.*

Meetings of Public Companies.

VANCOUVER COAL MINING AND LAND COMPANY.

The seventeenth annual general meeting of shareholders will be held at the City Terminus Hotel, Cannon-street, on Tuesday.

The report of the directors states that the accounts for the half-year ending Dec. 31, 1870, show a balance to the credit of profit and loss of 2073*l.* 15s. 10d. The sales of coal have exceeded those of the previous six months by 5265 tons. In consequence, however, of the exceptionally low prices which have ruled at San Francisco, and the continued accumulation of the coal in bin, having rendered it expedient to reduce the rates at the mine, the profit is considerably less than that of the former half-year. In view of the continuance of low prices the directors considered that the time had come to effect some proportionate reduction of the miners' wages. The men, however, resisting the proposed change, and exercising pressure upon those inclined to continue work, a general strike ensued, which, in spite of various attempts at accommodation, lasted six months. The directors were, however, informed by telegram that work was resumed. Although the amount of 2314*l.* 5s. 8d., written off for depreciation and repairs of plant, is less than for some preceding half-years, the usual scale of deduction has been maintained in respect of the principal items to which this charge applies, the difference being accounted for by the diminished output of coal. The directors continue to receive favourable accounts as to the condition of the mining works generally. The Douglas incline is completed, and satisfactory progress has been made in exploring the coal field at Newcastle Island, which promises to be a valuable reserve. The directors recommend a dividend of 5s. per share on paid-up shares, and of 3s. per share on ordinary shares, free of income tax, which, with the amount paid in November, will make 7½ per cent. for the year, and will absorb 2065*l.* of the available balance.

WEST BASSET MINING COMPANY.

At the special general meeting of shareholders, held at the offices of the company, on Wednesday, Mr. W. A. Thomas (the Chairman) having referred to the objectionable wording of the requisition, signed by Messrs. Daubuz and Co., H. Borrow, James Evans, and J. Hocking, jun., calling the special meeting, Mr. Hocking stated in explanation, that in requiring the removal of the present committee of management, there was no intention whatever to apply such removal to Mr. W. A. Thomas, and that the expression was used inadvertently, and that it was the desire of the requisitionists that he remain one of the committee, and Mr. W. A. Thomas having consented to remain a member of the committee of management, it was proposed by Mr. John Thomas, and seconded by Mr. J. B. Reynolds, and resolved, "That the committee appointed for the management of this mine having been reduced, by death and relinquishment, from three to one, that Messrs. J. C. Daubuz, of Killion, Truro, Cornwall, James Evans, of Nance, Illogan, Cornwall, and John Hocking, jun., of Redruth, Cornwall, be and are hereby elected members of the committee of management."

On the proposition to dissolve the boundary committee, Mr. Finch, the solicitor to the mine, who attended this meeting by request of the committee of management, advised that the resolution below be withdrawn, as, that in his opinion, such a resolution would only complicate matters, and would be entirely inoperative to stay further law proceedings, that it would be very detrimental to the interests of the mine, and prejudicial to the pending negociations for the renewal of the setts; notwithstanding which it was proposed by Mr. John Hocking, jun., seconded by Mr. James Evans, and resolved, "That the present boundary committee, consisting of Mr. W. A. Thomas and Mr. W. A. Buckley, be and is hereby dissolved." Messrs. J. Evans, J. Thomas, J. Hocking, jun., and J. B. Reynolds, voting in favour, and Messrs. R. McCallan, J. Roberts, W. A. Buckley, John Finch, and W. A. Thomas, voting against it.

HARLECH SILVER-LEAD, COPPER, ZINC, AND LEAD MINING COMPANY.

A meeting of the directors of this company was held at the offices, Gresham House, on Monday, for the purpose of affixing the seal of the company to the contract and transfer of deeds from the late proprietors to the trustees of the company, and other matters, as stated in the company's circular convening the meeting. Immediately after which the first ordinary general meeting was held, when the accounts and balance-sheet were presented, and, having been scrutinised, were found correct, and passed.

Reports from the mines were read, from which it appeared sales of sulphur ore had been effected to about the amount of 300 tons, 100 tons were now nearly ready for sale at an advance of 5s. per ton; that the quality of the mineral had been pronounced by the purchasers as being very superior, and that no difficulty will be experienced in disposing of any quantity that may be sent into the market. In addition to the sulphur, a large pile of silver-lead ore is at the bank, estimated at about 80 tons, which will be dressed as soon as appliances can be erected. The lode is said to be improving in size and quality as it goes into the mountain side, many thousands of tons of ore are in sight, being under cut in the deep adit, and over cut in the shallow adit. From this source alone dividends are certain, even should no further improvement or discovery be made; every day's experience, however, suffices to prove the lode both improves in quality and quantity.

These gratifying and substantial proofs of the value of their property gave great satisfaction to all present; applications were made for any unallotted shares, and the meeting expressed their full confidence in the value of the mine and the excellence of the management.

The cordial thanks of the meeting were voted to the Chairman and manager, who were requested to kindly continue their services, a motion that was received and carried amidst much applause.

A diagram of the mine was produced, and ordered to be published and sent to every shareholder, by which the merest tyro in mining may perceive the unusual prospects in this mine, which has already yielded such great returns, although only set to work by the present company within three months. This plan may be had on application at the offices.

Since the above was written offers to make contracts for many thousands of tons of sulphur ore, to the extent of more than 500 tons per week, have been received; it is believed that as soon as the mine is more fully laid open this vast amount of mineral will be procurable. As it is, at the present rate of produce a profit of 12s. per ton may be made, and a revenue of 6½ per cent. on the capital be secured from the sulphur ore alone.

EAST BLACK CRAIG MINES (KIRKCUDBRIGHTSHIRE).

An extraordinary general meeting of shareholders was held at the offices, 1, Hackins Hey, Liverpool, on Tuesday. After passing the accounts, the last report of the mining agent, Capt. Wm. Penberthy, was read, of which the following is an abstract:—

Our mine has been steadily improving. The new engine-shaft is complete, and lodge cut ready for sinking another lift. The 78 east driven 28 fms.; a trial on the north side has produced fine stones of ore, with every indication of nearing a large deposit of lead. The 78 west driven 29 fms., and we are evidently approaching the deposit seen in the 66. About 10 fms. west from engine-shaft, in the 78, we have gone over lead ground for about 4 fms., reserved for getting from lower levels. The stopes between the 66 and 78 are improving. In No. 4 cross-cut, in the 66, we have cut through two or three solid strings of lead bearing westerly towards the lode, which it will, no doubt, greatly enrich. The cross-cut south of the 66 is giving beautiful stones of lead. The tributers are, as usual, making fair wages. We are making trials in other parts of the mine, on which I will report in my next. I have now to tell you that we have discovered and opened a south lode about half a mile from the main shaft. A rib of solid lead, fully 3 in. wide, has been cut, doubtless the outcrop of a large deposit. Its junction with the main lode is about 40 fms. below washing-floors. At this point we may confidently expect a large deposit of lead. I am sorry to add that I am much retarded in my efforts by the want of men.

The CHAIRMAN explained that successful measures had been taken, by help of the *Mining Journal* and other papers, to get more miners. Also that since the foregoing report the cross-cut in the 78 is yielding good lead.

The directors then presented a report, expressive of great confidence in the near prosperity of the mine, and recommending the issue of more shares, in order to prosecute the recent discovery in the south lode, and to restore the workings at the western portion of the mines. As there are now three distinct sets of workings, equivalent to three separate mines, and all of great promise, they advised that a premium of 10 per cent. be required on all shares of the company sold after this date.

The adoption of the report was carried unanimously. In answer to enquiry, it was stated that only about 15 tons would be sampled for market this month, owing to the shortness of hands, and other causes. The secretary (Mr. V. W. Jones) produced estimates for the new works, machinery, &c. The directors explained that they will dispose of 100 (28*l.*) shares, at a premium of 10 per cent., to meet these costs, which will leave a reserve of nearly 200 unissued shares in the company's hands. The meeting then terminated in the usual manner.

[For remainder of Meetings see to-day's Journal.]

GEM TIN MINE.—On Saturday last this extraordinary young mine was the scene of considerable excitement on the occasion of celebrating the starting of a new engine-wheel, with all its necessary appendages, for forking the deepest part of the mine, which was witnessed by a numerous company of interested ladies and gentlemen from Plymouth and the adjoining neighbourhood. Soon after midday the indefatigable managing director, Mr. J. Legassick, gave orders for starting the ponderous machinery, which rolled round in majestic style, amid loud acclamations and cheers, with a unanimous voice of a thorough success, ascribing great credit to the resident agent, Captain Unsworth, who directed the whole operations in such praiseworthy manner, in starting the machinery without a screw being loose or any alterations required. Then followed the usual ceremony of naming this great development, which was christened by a young lady "Lucy's Engine-Shaft." The neat yet ponderous wheel, rolling round in the most gratifying manner, was then christened the "Elizabeth Wheel" amid loud and vociferous cheers. The principal part of the company then proceeded to the tin dressing-floors and minutely examined the accumulated stock and the scientific mode of treatment, all of which was declared to be a thorough success. The event was duly celebrated by all the operators as well as the company, and the utmost gratification was expressed by "one and all." Captain Unsworth, Captain H. Horswill, Captain G. Roe, and other miners fully endorsed the opinion of Mr. J. Legassick that the Gem mine could not fail of being a success.

CARN BREA MINES.—An important meeting was held at these mines on Wednesday, when it was unanimously agreed that the management should be transferred from London to Cornwall on the resignation of the London secretary. Capt. W. Teague, of Tincroft Mine was appointed managing director. The services of the committee will in future be gratuitous. A profit of 2029*l.* was shown on the quarter's working, and a balance of 4790*l.* in favour of the mines carried forward. The abolition of the London offices will save the company about 750*l.* yearly, and Capt. W. Teague by his skill and energy has effected a saving of about 800*l.* per month since the management has fallen into his hands. The report was most encouraging and shares were in great request at 80*l.* each. The mine is divided into only 1000 shares; its rich neighbour Tincroft, in 6000, commands a market value of 49*l.* to 50*l.* per share.

DEVON GREAT CONSOLS.—With reference to the report of the meeting of this company, published in the *Mining Journal* of May 13, Mr. Reginald Gill, of the Tavistock Bank, writes that it was not he, but a shareholder totally unknown to him, that asked the questions as to the aggregate expenditure, and the amount realised by the sale of copper, and as to whether dues were paid upon arsenic; that Mr. Blakeway (not Mr. Bromley) enquired of Mr. Gill whether he was a shareholder when the re-purchase of the Colcharton Mine was effected; that Mr. Page seconded the amendment for appointing Messrs. Chatfield and Gill auditors, and not the compensation to directors and auditors, as represented in the report; that the Rev. J. Huyshe, and not Mr. Gill, proposed a vote of thanks to the Chairman; and that Mr. Wills is much amused at the portion of the report as to his "returning to the county quite content." Mr. Gill further wishes it stated that he did not say "he had differences with" Mr. Thomas, but that "he had known Mr. Thomas for many years, and whatever differences of opinion existed on this matter, he hoped that this movement would not alter their friendship." Mr. Gill adds, moreover—"During the many years Devon Great Consols has been worked, our firm has acted as its local bankers, and we employ Messrs. Thomas as our broker in buying or selling stocks, negociating loans, &c., and not a single unpleasant feeling or word has ever passed between us; it is only because the shareholders in the neighbourhood consider the management at present far too expensive that they attended the meeting, to bring it before the directors and shareholders."

FLORENCE AND TONKIN.—One of the most practical and recognised authorities as regards lead lodes, Capt. Thomas Foote, of the Trewetha and South Ward Mines, and formerly of the extensive Tamar Lead Mines, strongly recommends the driving of the 45 on the lead lode with all speed, which is a very important point of operation. He says, alluding to the lead lode in the 35 fm. level—"It is producing good stones of lead, with lime, spar, &c.; in fact, all that can be expected so near the copper lode; and, looking at the fine gossan at the back, there is no fear of this lode being a very valuable one in the falling ground to the south. A decided improvement has taken place within the last few feet driving, and I am fully persuaded that by pushing the levels west for copper, and south on the lead lode, this will prove a good and lasting property." Capt. Richard Pryor, who has had great experience in this district, has made a most minute examination of the Florence Mine, and his opinion may be regarded with the greatest confidence. He thus concludes a very detailed description of the work done, and that which he recommends for the future—"I have not visited a mine for a long time that holds out better chances of success, and all, in my opinion, that is wanted is a spirited application of capital to open up a good and lasting property—one which will repay the adventurers for their perseverance and outlay." In reference to the Great Champion lead lode, Captain Cornish, managing agent of Frank Mills Lead Mine, has also given highly encouraging testimony as to its splendid character and composition, and expresses himself in very positive terms as to the probability of its yielding great returns of silver-lead. Another correspondent thus corroborates these favourable opinions—"I refer more particularly to the north and south silver-lead lode, which, judging from the large mass of beautiful gossan seen on the back of it, and the very congenial matrix in the drivings in the 35 and 45, together with the highly mineralised stratum of clay-slate which accompanies the lode, and being near to, and parallel with, the Callington Mines silver lead lode, which formerly yielded very large quantities of lead rich for silver, I am most sanguine that large deposits of silver-lead ore will be discovered in driving south under this mass of rich gossan." Surely such expectations cannot fail to be realised by a persevering and judicious development of the mines.

EAST TERRAS.—This mine bids fair to rival, if not surpass, its now rich neighbour. The most recent advices are all that the most sanguine adventurer could reasonably expect or desire. The agent, Capt. James, writes on Monday last, "The new shaft is down about 4 fms.; we have a splendid lode of rich tin, and shall soon be in a position to make large returns." In order that there shall be no misconception of these terms, the managing director begs it to be remembered that the East Terras being in virgin ground the tin is found near, or rather at, the surface. The backs of the lodes not having been stripped by the "old men," and that before any very great returns can be made ground must be laid open, and machinery erected; this will be done as fast as is practicable. In the meantime he begs the shareholders not to expect too much too soon; a comparative brief period, and the East Terras will be a rich tin mine.

HARMONY AND MONTAGUE (Redruth).—The proceedings at these mines are all that can be desired, great activity is being displayed, and large quantities of tinstone are being raised, and this, too, of a quality very far superior to what the most sanguine of the promoters anticipated. The quantity undercut and obtainable at the same cheap rate is practically inexhaustible for a generation at least. Measures are being taken for the immediate erection of a rotary-engine to draw tinstone (there are no deads to haul) to the surface, drive one of Blake's stone-crushers of large size, which will soon be on the ground, and work the dressing machinery. Contracts are being made for erecting a powerful battery of stamps, or modern equivalents and appliances. These will probably be extended to 500 or 600 heads, for which large number ample work will be procurable without sinking an inch or driving a single level. It is intended, however, when the works were more advanced to drive cross-cuts and intersect side lodes known to exist, and to be rich in copper as well as tin ore. No wonder under such circumstances the shares are in great demand (only 6*l.*), and have already gone to a great premium, and steadily advancing.

BRONFLOYD.—There has been a very perceptible difference in the matrix of the north lode in this mine during the sinking of the last draft of the main shaft (73 to 84), it being of a much harder and closer texture, having the appearance of carrying more silver, and is altogether more like the rich character of the south lode of the mine, from which a few years ago silver ore was raised which realised upwards of 16*l.* per ton. The run of the ore in the 84 continues without change, and is worth quite 3 tons per cubic fathom. To test its comparative value for silver, the following assays have been made by Mr. Jenkins, of Callington (May 18). No. 1 sample (84 fm. level), 77½ per cent. lead, 18 ozs. 6 dwts. 16 grs. of silver in the ton of ore; No. 2 sample (73 fathom level), 81¼ per cent. lead, and 9 ozs. of silver; No. 3 (Slimes), 80¾ per cent. lead, and 16 ozs. 6 dwts. 16 grs.; whilst the silver contained in the 73 and upper levels is proved by the Burry Port Company (as buyers of the last three parcels of ore), who, at the request of the managing director, has kindly furnished the actual yield of the said three lots has under:—70 tons, 78 per cent. lead, 10½ ozs. per ton of ore; 60 tons, 80 per cent. lead, 10½ ozs. per ton of ore; 100 tons, 78 per cent. lead, 10 ozs. per ton of ore.

SOUTH WALES COAL AND METAL MARKETS.—At the meeting held at the King's Head Hotel, Newport, there were present:—Messrs. H. A. Swan, John Leybourne, A. J. M. Aitken, W. Struthers, Henry Green, John W. Jones, C. D. Phillips, C. Simpson, R. W. Jones, J. Railton, J. Murphy, W. G. Lovell, Cadle, C. Conway, T. B. Batchelor, H. Evans (Saunders and Piper, Cookley), A. Jones (Usksides Co.), H. Huzzey, John James, Henry M'Niel (M'Niel, Muller, and Co.), C. Gratrex, R. S. Roper, hon. sec., &c. Mr. C. D. Phillips exhibited Bond's patent keyless chair and Cambridge's patent fire-bar. The keyless chair consists of a bed and an immovable and movable jaw. The movable jaw is made secure to the bed by means of a bolt and levelled-sided nut, and projections, and groves, &c. It can be removed as circumstances may require. These keyless chairs are now in use on various parts of the Sirhowy Railway, where it has been tested successfully on the sharpest curves, and those parts of the line over which the greatest amount of traffic passes. The Cambridge patent fire-bars, although much more expensive in first cost than ordinary fire-bars, are strongly recommended by many gentlemen who have given them a fair trial. Scotch pigs are quoted at higher prices, and Middlesborough, Scend, and hematite pigs are being sold at full market prices, and the quantity in stock for sale is reported to be very small in the Lancashire, Cumberland, and Cleveland districts. Rails are quoted at 6*l.* 17s. 6d. to 7*l.* 2s. 6d. per ton, and the tendency of price is upward. Mr. Roper exhibited samples of the King Sutton (Oxfordshire) ore, from the top, middle, and bottom beds. This ore is somewhat cheaper than Northamptonshire ore, contains about the same percentage of iron, and a large percentage of carbonate of lime. Samples of Spa-those ore were also exhibited by Mr. Roper. Analysis shows this ore to contain 45·3 per cent. of iron, 4·95 per cent. of silica, 1·81 of alumina, 4·5 of manganese, and small quantities of sulphur and phosphorus. Samples of brown hematite ore, containing much manganese, were also shown. The feeling of the market was very cheerful, and there is a general impression that the staple trades of the district are likely to improve. An enquiry for a large lot of British larch timber, for mining purposes, was a feature of the market.

At the meeting at Swansea, Mr. C. D. Phillips exhibited a waterproof apron for the use of tin-girls. They are sold at 4s. 9d., according to size. —Mr. Rosser exhibited samples of spathose ore, brown hematite, and a new variety of ore from Bilboa.—Mr. Thomas (Bacon and Co.) exhibited samples of tin plates, made at the Landoro Tin-plate Company's Works from Yorkshire refined metal, manufactured by the patent process alluded to in our last report. The plates were carefully inspected, and reported to be very good. Tin-plates are reported to be sold at better prices, and are firm, for best charcoal plates, at 28s., and coke at 23s. 6d. Wiltshire pigs are firm, as also are Middlesborough, hematite, Forest of Dean, and all other mine pigs, though we heard that Middlesborough pigs were sold at less than ordinary list prices. Very large quantities of Spanish ore have been sold recently.

CHEAP RAILWAY FARES.—A pamphlet has just been issued by Mr. F. BOUCHER, of Moorgate-street, pointing out to railway companies the increased profits to be anticipated from the adoption of very low fares. He suggests a uniform rate of 1d. for five miles second-class, any portion of five miles being charged the five-mile rate; had he proposed 1d. per five miles for third-class, 1½d. second, and 2d. first-class, we think it would have been preferable. Mr. Boucher estimates that on the Metropolitan Railway 1000 persons would immediately and continuously travel for every one passenger at present fares, and he observes that at the numerous suburban stations of the Metropolitan lines of railway, very low fares, rates and charges for the conveyance of goods, merchandise, and parcels, would occasion a vast and continuous increase of the traffic and communication. This increase would prove highly profitable and advantageous to the shareholders of the railways, and extremely convenient to the public. Parcels up to 28 lbs. weight should be charged 1d. only, to or from any station on the railway to any other station. This would cause a vast number of small parcels to be sent daily by the railway, and although 28 lbs. would be the largest that would be conveyed for one penny, the same fare would be charged for any smaller parcels. He considers that the introduction of penny fares, as advised, upon each and all of the metropolitan lines of railway, will surely and immediately lead to their affluence and continuous prosperity. Their shares will rise in value, by reason of good dividends being paid thereon! Their surplus funds will enable the directors and managers to introduce desirable improvements of all kinds upon their lines.

CHEAP RAILWAYS.—A small experiment in cheap railway construction is mentioned from America, which seems to surpass previous similar attempts in that country. The line in progress is a length of 30 miles, in the State of Missouri, of which one is finished. The cost of this mile, laid with T iron, has been 1300*l.*, and the cost of the entire 30 miles is estimated at 53,000*l.*, allowing 350*l.* for culverts, bridges, &c. The road-bed is 6 ft. wide on the top, following the rise and fall of the ground, where it does not exceed 70 ft. to the mile, and winding round high hills and steep grades in curves of 200 ft. radius, less than one-third of those required for the ordinary gauge.

FOREIGN MINES.

DON PEDRO NORTH DEL REY (Gold).—Copy of telegram from Lisbon:—Weighed to April 29, 3785 oits.; estimate for April, 5085 oits.

BATTLE MOUNTAIN.—Capt. Richards, May 4: There is no material alteration in the mine since last report, except that the 73 north is promising improvement; there is a fine stone of rich black oxide now coming in. Ore raised 300 sacks.

EXCHEQUER (Gold and Silver).—L. Chalmers, May 2: During the week ending the 29th ult. 17 feet of drifts were run from the 140 ft. level in the winze. I have not yet commenced stoping, but shall on Monday. The seam of ruby silver, referred to in my last, though not very rich ($20), is widening out. When at the mine on Friday I picked into a spot in the main tunnel, about 150 ft. north of the winze, and found a sheet of good-looking quartz. My assay of it gives—gold, $80·92: silver, $60·50. This speaks well for the north stope.

PESTARENA UNITED (Gold).—Thomas Roberts, James Mitchell, May 17: We consigned this morning to Signor Giovanni Franzi, on account of the present month, five ingots of gold, weighing 9461 grammes, equal to 302 ozs. 5 dwts. 1 gr., obtained in 13 days.—Val Toppa: In the end driving north of second cross-cut west in No. 2 level, the lode is not so large as when last reported, and producing at present 8 tons per fathom, at 10 dwts. per ton. The end driving south in No. 2 level, on the new lode, is yielding 10 tons at 10 dwts., and the winze 10 tons, at 9 dwts. The rise on the flat lode, south of No. 1 cross-cut, is producing 8 tons per fathom, at 15 dwts. per ton. The drivage north, on the western part of the quartz lode, is improved, yielding 8 tons per fathom, at 10 dwts. per ton. The end north of cross-cut on this lode, above No. 2 level, is producing 8 tons per fathom, worth 1 oz. per ton, and end south of cross-cut 5 tons, at 9 dwts. per ton. The new cross-cut west continues to produce good stones of ore. No change in any of the stopes throughout the mine.

CAPE (Copper).—The directors have received dispatches. The Ooklep report states that the engine-shaft below the 48 fm. level continues to be sunk in a splendid course of copper ore. The north and south levels driven from it also continue in good ore ground, yielding about 9 and 6 tons per fm. respectively. Smelting was progressing satisfactorily. The calciner is completed, and acting to Mr. Thielen's satisfaction, and, as his continued experiments have convinced him that the profit on the reverberatory furnace depends upon the use of calcined ore, he has stopped that furnace until the end of April, so that a good stock of such ore can be prepared to enable the work to go on steadily.—Returns for March: Yield from Ooklep, 575 tons; Spectakel, 110 tons; smelting works, 60 tons of regulus. Transport to Port Nolloth, 109 tons of regulus and 435 tons of ore; to Hondeklip, 46 tons of ore: 600 tons of ore were sold by public ticket on the 16th inst., at an average of 14s. 1½d. per unit. The cargo per Patagonia, 431 tons, has been put forward for sale by next ticketing.

[For remainder of Foreign Mines see to day's Journal.]

NATURAL GAS.—The journals of Cleveland, Ohio, are commenting with interest on the discovery, in that city, of the presence of natural gas beneath the bed of shale which underlies that region of the country. The discovery was made by boring an Artesian well, which, it was intended, should be 1500 ft. deep. A pipe, eight inches in diameter, was forced down through quicksand 100 ft., and nothing unusual was observed. A few feet further down shale was encountered, and, by the time the pipe had reached 101 ft., the presence of gas was made known by a pressure that threw off a 70 lb. weight. The gas continued to flow from the pipe in a large volume, and a small gas-pipe being attached, a bluish-white light, having a great intensity of heat, appeared on the application of a match. As at Erie, Pa., natural gas is extensively used for fuel, the people of Cleveland are anticipating that similar advantages will be obtained for themselves from this discovery.

NEW TUNNELING MACHINE.—Col. Von Schmidt, of this city, has invented a tunneling machine, of which the following description is given:—The machine is constructed upon the severance diamond drill principle, but in the mode of application the machine differs materially from all others at present in use. It consists of a circular wheel, eight feet in diameter. Imbedded in the rim of the wheel, each revolving on its own account, will be twenty-four diamond drills, one foot apart. In the centre of the wheel is a single drill—and this is kept one foot in advance of the other drills. The wheel is calculated to make 8·0 revolutions per minute, the drills revolving at a higher rate of speed. The periphery of the tunnel will be on the scale of eight feet; the groove cut by the drills will be two inches wide and three feet deep. It is intended to load the centre hole alone, then run the machine back on the track, and raise the lower half of wheel on hinges. The blast is fired, and the great cheese of rock crumbles to pieces. The machine is so constructed as to admit of three feet space inside of the wheels, between its framework and the bed of the tunnel, and facilities for removing the debris are afforded by an inner car track. The machine will be run by compressed air.—*Mining and Scientific Press* (U.S.)

RAISING AND LOWERING WEIGHTS.—The invention of Mr. E. D. THOMAS, Abergavenny, relates to those apparatus which can be lowered from a window or other convenient part of a house or building by a person in a cage or basket, and consists in the employment of two ropes or chains upon a barrel of two diameters fitted within a box or case, which, if used as a fire-escape, should be placed under the window and inside the room. One of the ropes or chains is intended for supporting the weight of the cage or basket, while the other serves to regulate the descent of the cage. It is preferred that the regulating rope be worked by the person in the cage, but this is not essential, as it can be worked by another person in the room or some one outside.

COPPER ORES.

Sampled May 3, and sold at the Royal Hotel, Truro, May 18.

Mines.	Tons.	Price.	Mines.	Tons.	Price.
Devon Great Consols..	108	£4 2 6	Marke Valley	72	£3 7 0
ditto	100	1 6 6	ditto	70	1 0 0
ditto	98	0 11 6	ditto	51	2 18 6
ditto	93	0 11 6	ditto	50	2 4 0
ditto	92	1 7 0	Brookwood	68	2 13 6
ditto	91	3 8 0	ditto	58	2 7 0
ditto	90	2 9 0	ditto	51	1 17 0
ditto	89	2 7 0	ditto	41	4 17 6
ditto	85	4 11 6	ditto	33	10 14 6
ditto	84	0 11 6	ditto	28	4 18 0
ditto	83	2 8 6	East Caradon	77	4 11 6
ditto	60	3 16 6	ditto	70	5 11 6
ditto	78	1 5 6	ditto	49	1 10 6
ditto	77	0 9 0	Wheal Friendship	106	5 15 6
ditto	69	1 15 0	ditto	57	1 16 6
ditto	67	4 12 6	ditto	23	12 10 6
ditto	66	1 2 6	Gunnislake (Clitters)	73	3 5 0
ditto	53	1 13 6	ditto	56	5 14 0
ditto	50	2 16 6	ditto	54	4 4 6
ditto	27	1 18 6	West Maria & Fortes.	60	2 17 6
ditto	26	3 17 0	ditto	50	2 15 6
ditto	18	0 15 0	ditto	35	6 9 0
South Caradon	75	11 16 0	West Caradon	65	3 11 0
ditto	72	10 9 0	ditto	55	4 1 6
ditto	69	2 10 6	Wheal Crebor	73	3 2 6
ditto	60	4 16 6	ditto	43	3 2 6
ditto	57	4 12 6	Virtuous Lady	68	5 13 6
ditto	56	1 6 0	ditto	8	9 10 6
ditto	55	5 5 6	Prince of Wales	60	4 11 6
ditto	53	4 6 6	Florence and Tonkin	21	4 0 0
ditto	52	4 9 6	Williams's Ore	13	2 11 6
ditto	40	7 5 0	Sortridge Consols	6	1 9 6
Marke Valley	100	2 9 0	ditto	5	0 18 0
ditto	90	2 18 6	Duke of Cornwall	10	2 7 6
ditto	75	4 2 6	Westlake's Ore	9	0 8 0

TOTAL PRODUCE.

Devon Great Con.	1624	£3553 4 0	Wheal Crebor	116	£ 362 10 0
South Caradon	589	3369 12 0	Virtuous Lady	76	462 2 0
Marke Valley	508	1419 10 0	Prince of Wales	60	274 10 0
Brookwood	276	1071 7 6	Florence & Tonkin	21	84 0 0
East Caradon	196	817 5 0	Williams's Ores	13	33 9 6
Wheal Friendship	186	1004 5 0	Sortridge Consols	11	13 7 0
Gunnislake, &c.	181	784 12 0	Devon & Cornwall	10	28 15 0
West Maria, &c.	145	537 0 0	Westlake's Ores	9	3 12 0
West Caradon	129	454 17 6			

Average standard..... £101 13 0 | Average produce..... 6⅛
Average price per ton..... £3 9 0
Quantity of ore.....4143 tons | Quantity of fine copper..252 tons 10 cwts.
Amount of money..... £14,268 18 6

LAST SALE.—Average standard..... £ 96 5 0—Average produce..... 7¼
Standard of corresponding sale last month, £102 6 0—Produce, 6⅜.

COMPANIES BY WHOM THE ORES WERE PURCHASED.

Names.	Tons.	Amount.
Vivian and Sons	962½	£2642 19 0
Sims, Willyams, and Co.	816½	4846 7 6
Williams, Foster, and Co.	938	3742 4 0
Mason and Elkington	398	911 19 6
Copper Miners' Company	209½	701 10 9
Charles Lambert	682½	1165 6 9
Sweetland, Tuttle, and Co.	121	379 0 0
Total	4143	£14,268 18 6

Copper ores for sale at Tabb's Hotel, Redruth, on Thursday next—Mines and Parcels.—West Tolgus 329—West Seton 825—Wheal Seton 293—Crenver and Abraham 215—South Crofty 290—East Pool 187—North Crofty 117—North Downs 100—Wheal Basset 72—Wheal Jewell 48—Clifford 36—North Roskear 14—Tolcarne 6.—Total, 1912 tons.

TANGYE BROTHERS AND HOLMAN,

10, LAURENCE POUNTNEY LANE, LONDON,

CORNWALL WORKS (TANGYE BROTHERS), BIRMINGHAM,

SOLE MAKERS OF

THE "SPECIAL" STEAM PUMPS.

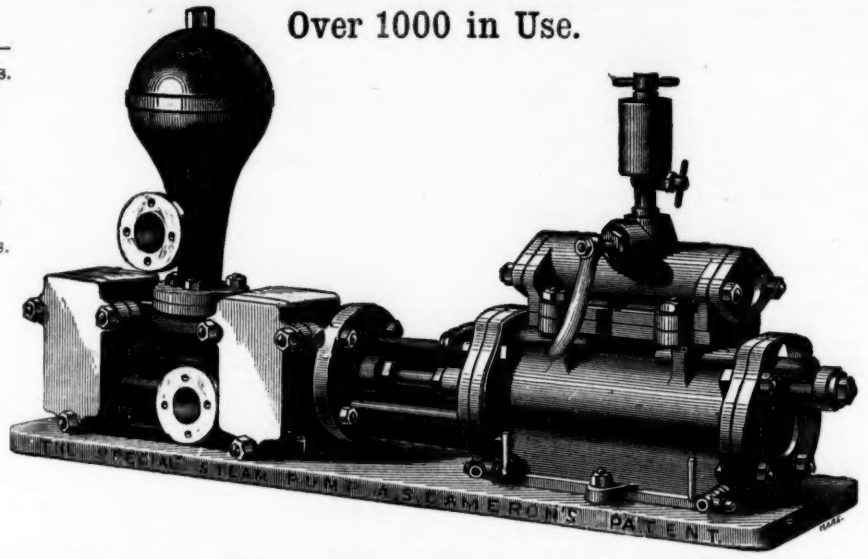
Over 1000 in Use.

IN USE AT THE FOLLOWING QUARRIES:—

Carnarvon and Bangor Slate Co. ...	5	Pumps.
Kellow, J. E., North Wales Slate Co...	1	„
New Zealand Quartz Crushing and Gold Mining Company...	1	„
Scott, R W., Dungannon, Ireland ...	1	„
Foster, J. S., Hebburn Quarries ...	1	„

IN USE AT THE FOLLOWING CHEMICAL WORKS:—

Alum and Ammonia Co., Bow Common	2	Pumps.
Barnes, W. C., Hackney Wick... ...	2	„
Burt, Boulton, and Hayward, Tar Works, Millwall	1	„
Cory and Co., Manor-street, Old Kent-road	2	„
Whiffen, Thomas, Battersea	1	„
Jones, W., and Co., Middlesborough...	4	„
Jarrow Chemical Co., South Shields..	1	„
Richardson, J. G. and N. H., Jarrow-on-Tyne	1	„
Read, Holliday, & Sons, Huddersfield	1	„
Sheldon, Nixon, and Co., West Jarrow	2	„
Tennant, C., and Co., near Newcastle.	7	„
Webb, H., & Co. (Manure), Worcester	1	„
Union Chemical Company, Stratford..	1	„



NOTE.

Requires NO Shafting, Gearing, Riggers, or Belts.

All Double-Acting.

Works at any Speed, and any Pressure of Steam.

Will Force to any Height.

Delivers a constant stream.

Can be placed any distance away from a Boiler.

Occupies little space.

Simple, Durable, Economical.

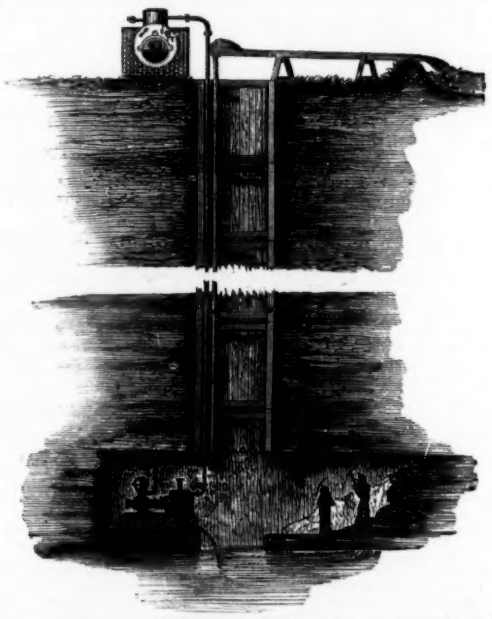
IN USE AT THE FOLLOWING COLLIERIES:—

Adelaide Colliery, Bishop Auckland	3	Pumps.	North Bitchburn Colliery, Darlington	2	Pumps.
Acomb Colliery, Hexham	1	„	Newton Cap Colliery, Darlington...	1	„
Blackfell Colliery, Gateshead	1	„	Normanby Mines	1	„
Black Boy Colliery, Gateshead	1	„	Oakenshaw Colliery	1	„
Castle Eden Colliery	2	„	Pease's West Colliery	2	„
Crofton, J. Ct., near Ferryhill	1	„	Pease, J. and J. W., near Crook	5	„
Carr, W. C., Newcastle	4	„	Pease, J. and J., Brandon Colliery	1	„
Etherley Colliery	1	„	Pegswood Colliery, near Morpeth	2	„
Gidlow, T., Wigan	3	„	Pelton Fell Colliery	1	„
Haswell, Shotton, and Easington Coal Co. ...	2	„	Railey Fell Colliery, Darlington	1	„
Lochgelly Iron and Coal Company	1	„	Right Hon. Earl Durham, Fence Houses ...	1	„
Leather, J. T., near Leeds	2	„	Skelton Mines	1	„
Lumley Colliery, Fence Houses	1	„	South Benwell Colliery	4	„
Monkwearmouth Colliery, Sunderland... ...	1	„	St. Helens (Tindale) Colliery	1	„
Stott, James, and Co., Burslem	1	Pumps.			
Seaton Delaval Coal Company, near Newcastle	1	„			
Thornley Colliery, Ferryhill	1	„			
Thompson, John, Gateshead	2	„			
Trindon Grange Colliery	1	„			
Tudhoe Colliery	4	„			
Vobster and Mells Colliery	2	„			
Widdrington Colliery, Morpeth	2	„			
Whitworth and Spennymoor Colliery	3	„			
Westerton Colliery, Bishop Auckland	1	„			
Wardley Colliery, Gateshead	1	„			
Westminster Brymbo Coal Company	2	„			
Weardale Coal and Iron Company	5	„			

IRONWORKS AND ROLLING MILLS:—

Bede Metal Company, Jarrow	11	Pumps.	Gilkes, Wilson, Pease, and Co., Middlesboro'..	2	Pumps.
Bagnall, C. and T., Grosmont Ironworks ...	2	„	Lloyd and Co., Middlesborough	1	„
Consett Ironworks	2	„	Solway Hematite Iron Company, Maryport ...	1	„
Castleford Foundry Company, Normanton ...	1	„	Vaughan, Thomas, Middlesborough	2	„
Ellen Rolling Mills, Maryport	1	„	The Shotts Iron Company, Edinburgh	1	„
Whitwell and Co., Stockton	3	Pumps.			
Whessoe Ironworks, Darlington	1	„			
West Cumberland Hematite Iron Company ...	1	„			
Westbury Iron Company	1	„			

THE "SPECIAL" STEAM PUMP AS APPLIED FOR DRAINING MINES.



The arrangement in the accompanying illustration shows an economical method of draining mines without the expense of erecting surface-engines, fixing pump-rods, or other gearing. A boiler adjacent to the pit's mouth is all that is necessary on the surface; from thence steam may readily be taken down, by means of a felted steam-pipe, to connect the pump with the boiler. The pump may be placed in any situation that may be convenient for working it, and connecting the steam, suction, and delivery pipes.

These engines can be fixed and set to work in a comparatively short time, and also at a very small outlay. They are used in large mines as auxiliary engines, and will be found invaluable adjuncts in all mining operations.

To estimate the quantity of water to be raised by any given size of pump refer to the tabulated list below. It is recommended to use long-stroke pumps where the height exceeds 100 ft., so that the largest result may be obtained with a minimum wear and tear of the pump pistons and valves. The pumps are provided with doors for ready access to all working parts.

PRICES OF THE "SPECIAL" STEAM PUMPS.

Diameter of Steam Cylinder .....inches	2½	3	4	4	6	6	6	7	7	7	8	8	8	8	10	10	12	12	14	16	24
Diameter of Water Cylinder .....inches	1¼	1⅝	2	4	3	4	6	5	6	7	4	6	7	8	6	7	8	10	12	7	10
Length of Stroke .....inches	6	9	9	12	12	12	12	12	12	12	12	12	12	12	12	12	18	24	24	24	24
Strokes per minute	100	100	75	50	50	50	50	50	50	50	50	50	50	50	50	50	35	—	—	—	—
Gallons per hour	310	680	910	3250	1830	3250	7330	5070	7330	9750	3250	7330	9500	13,000	7330	9500	13,000	—	—	—	—
PRICE	£10	£15	£20	£35	£30	£40	£40 10	£50	£52 10	£57 10	£50	£55	£65	£75	£70	£80	£100	—	—	—	—

IF BRASS LINED, OR SOLID BRASS OR GUN-METAL WATER CYLINDERS, WITH COPPER AIR VESSELS, EXTRA, ACCORDING TO SIZE.

Any Combination can be made between the Steam and Water Cylinders, provided the Lengths of Stroke are the same, thus—8 in. Steam and 3 in. Water, or 10 in. Steam and 3 in. Water, adapted to height of lift and pressure of steam, and so on.

TANGYE BROTHERS & HOLMAN, 10, Laurence Pountney-lane, London, E.C.

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